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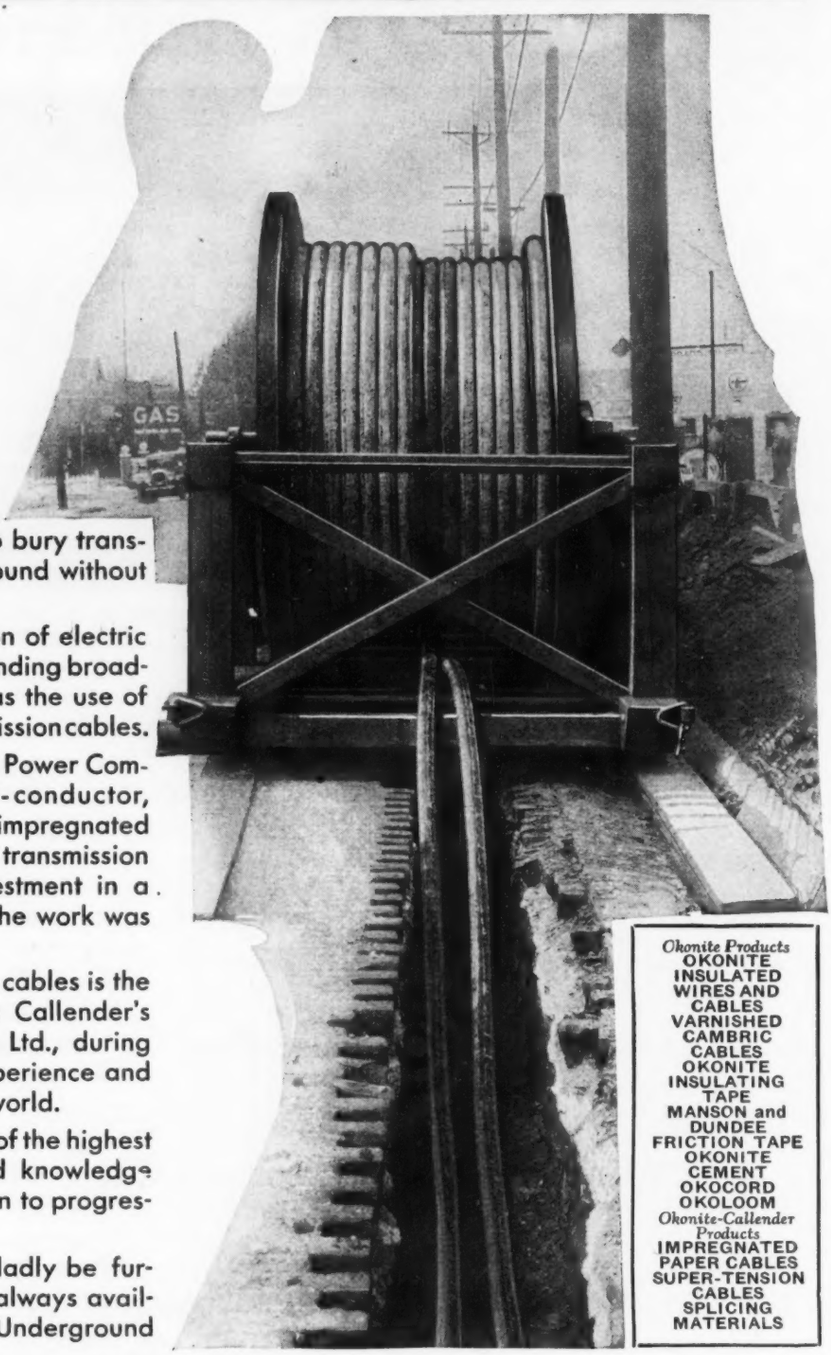

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ELECTRICAL WORLD

for the Week Ending

July 12, 1930

Power, not scenery, to govern licensors

N.E.L.A. to Atlantic City in 1931

Canadians report on St. Lawrence

Boulder Dam preliminaries started

—HYDRO developments under Power Commission jurisdiction are to be judged on power, not scenic or recreational bases, decides Attorney-General Mitchell, who denies that Congress specified any but navigational protection in creating power board.

—RATES in Indiana may be widely affected by Martinsville case scheduled for federal court decision. More than 70 petitions by cities for lower rates depend on case to establish just what intangibles shall be considered in rate making.

—BOULDER DAM preliminary operations start as Secretary Wilbur wires instructions to site. Union Pacific offers to build "easy" section of needed rail line, but no one appears anxious to tackle the more difficult parts.

—SUBSTATION with base 86 ft. below street level, designed for maximum utilization of space, brings 25,000 kw. in rotary converters together with all auxiliaries and 49,000-amp. battery in 225x60-ft. area.

—SYSTEM survey leads Georgia utility to improve transformer loadings and permits many minor improvements. Profitable rehabilitation need not be confined to complacent energy users.

—STREAM flow fully utilized by twelve plants on Catawba River in Carolinas. Co-ordinated operation permits highest efficiencies and ample flood control. United action wins again.

—PRIEST RAPIDS project, involving 200,000 hp. on Columbia River, loses license as commission makes effective its threat to demand proof of market for power—a move to make all applications active ones.

NEWS OF THE WEEK

Mitchell Says Power Board Cannot Act on Esthetic Grounds

THAT the Federal Power Commission has no power to refuse a license to an applicant for a hydro-electric site in order to preserve scenery or recreational opportunities is the most important decision announced in a long communication addressed to the President by Attorney-General William D. Mitchell on July 1, in response to six questions posed by the Secretary of War in his capacity as acting chairman of that commission.

These questions, though some of them are framed in general terms, all relate to the application of the Cumberland Hydro-Electric Power Company, an Insull property, for a license to develop Cumberland Falls in Kentucky. This project aroused intense hostility from scenery preservationists and led the Kentucky Legislature to pass a law authorizing the acceptance of an offer from former Senator du Pont to purchase the property for the state, which would convert it into a public park.

Specific answers given

Attorney-General Mitchell's decision on the points involved may be epitomized as follows, the language employed being his own as excerpted from his communication:

Q. The first question submitted is whether the commission has jurisdiction to entertain on its merits the application for license for this dam on upper non-navigable reaches of the Cumberland River.

A. I am of the opinion that the commission has jurisdiction.

Q. The next question submitted is whether the navigable capacity of a given stream may be referred to and determined by the Attorney-General upon a statement of the evidence, or whether it is a question of fact to be determined by the Federal Power Commission.

A. With this test of navigability [one laid down by the United States Supreme Court] established, the question whether a particular stream is navigable becomes one of fact. Not only the evidentiary facts, but the ultimate fact of navigability, is one which, in dealing with applications for license, the Federal Power Commission is required by this act to determine.

Q. The next questions submitted are whether in considering applications for licenses the commission must confine its attention to the interests of interstate and foreign commerce, or whether it may consider, in deciding whether to grant a license, esthetic, recreational, scenic and other like features of the situation.

A. The United States has no power to prevent the erection of a dam at Cumberland Falls unless the effect of the dam would be to impair substantially the navigable capacity of the lower reaches of the river. It could not prevent the erection of the dam because it would interfere with the scenic or recreational facilities at that point, and Congress has not by the terms of this act attempted to confer upon the commission the power to refuse a license because of such considerations.

Q. The last questions submitted are whether the Federal Power Commission has jurisdiction to grant a license purporting to protect the licensee against interference by the authorities of the state government, and in that connection whether the steps taken by the State of Kentucky looking toward the acquisition by the state for park purposes of an area including Cumberland Falls operate to terminate the authority of the commission relative to the proposed project.

A. In the absence of the actual acquisition by the state, or of facts showing that such acquisition is a certainty in the near future, it is the duty of the commission to pass on the application and grant or deny it as the facts may require. Otherwise, the state might withhold action indefinitely in the matter of the acquisition of the property, and the commission would be

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EMULATING JUPITER IN TENNESSEE

—*Wide World Photos*

Research engineers are still on the trail of the lightning flash. Here is some portable Westinghouse generator equipment set up in the mountains of Tennessee to furnish artificial thunderbolts when real ones are too bashful to appear.

withholding action indefinitely on the application for a license, and the applicant, not being able to proceed without a license, would be deprived indefinitely of the use of its property.

It would thus seem that if the Cumberland Hydro-Electric Power Company persists in its application for a license and contests the right of the state to condemn its property for park purposes, the fight over this site is still on. Moreover, a principle has been set up that will have wide application in other cases.

▼

Potomac Great Falls Power Applications Fail

REJECTION without prejudice has met the three applications to the Federal Power Commission for a preliminary permit to develop the Great Falls of the Potomac for water power. The most widely advertised of these was from the Potomac River Corporation, controlled by the Byllesby interests. One of the others was from the South Branch Power Company, and the third application was from Albert M. Quick and W. H. H. Stineman. The Byllesby application, the earliest of the three, had been pending three years.

This disposition of the projects was based by the commission on the Cramton act passed by Congress to establish a public park on the site sought for power development. F. E. Bonner, executive secretary of the Power Commission, explained this in a letter to the unsuccessful applicants, which was made public on Wednesday, and added:

"As the project for the parkway will occupy in part the area included in the project covered by your application for a preliminary permit, your application is rejected without prejudice to the filing of a new application not in conflict with the parkway or for a project for which congressional authority can be shown."

▼

Water Power Interests U.S. Chamber of Commerce

THE water-power policy committee of the United States Chamber of Commerce has finished its work in shaping a proposed guide for the chamber's future action and attitude with regard to power problems. The report was approved on June 27 by the directors of the chamber, but will not be made public until it goes to referendum, probably some time this fall. At that time an extensive factual survey on which the report was based will also be released except for the section on Muscle Shoals, which is already in circulation.

WILL HE REPEAT?

General Edgar Jadwin, chosen by the President to head the new Federal Power Commission, is here seen taking the oath of office as chief of army engineers, a few years before his retirement. It will be up to the Senate to decide whether he will again be mustered into the service of the nation.

▼

Power Nominations Wait —Jadwin Will Be Fought

NO NOMINATIONS for membership in the reorganized Federal Power Commission had been sent to the Senate up to the time the ELECTRICAL WORLD closed its forms. It is assumed that the President will not forward these names until the naval treaty shall have been ratified or a time fixed for a final vote. It is apparent that a strenuous effort is being made to organize opposition to the confirmation of Lieut.-General Jadwin, whom, as announced last week, the President has selected for the chairmanship of the commission.

The opposition to General Jadwin, it is stated, will be based upon claims that he has favored power companies in his reports. He also is being criticised for having recalled Colonel William Kelly to the service after he had entered upon duties for the Niagara Falls Power Company. Colonel Kelly was recalled to direct a reservoir study in connection with the flood-control program. Exception also is taken to the position General Jadwin took with regard to the disposition of Muscle Shoals and because of the report he made favoring the utilization of the power resources of the Potomac at Great Falls in conjunction with the park plan. General Jadwin's personal course in the matter of Mississippi River flood control and in connection with the commission studying the Nicaraguan Canal, of which he is chairman, has also aroused much opposition, among civil engineers as well as from politicians. His flood-control plan has been under constant fire since it was made public late in 1928.

▼

N.E.L.A. 1931 Meeting, Atlantic City, June 8-12

OFFICIAL announcement was made this week by A. Jackson Marshall, secretary National Electric Light Association, that the 1931 convention of that body will be held at Atlantic City, N. J., in the auditorium and convention hall, on June 8 to 12 inclusive.

▼

Canadian Engineers Issue New St. Lawrence Report

A DOUBLE-STAGE deep-water navigation and power development costing about $274,020,000 is envisaged in the report just issued of a conference between members of the Canadian section of the Joint International Board of Engineers and representatives of the Ontario Hydro-Electric Power Commission who investigated the deep-water and power possibilities of the St. Lawrence in the international rapids section of the river.

The development recommended in the present report differs in some minor respects from the double-stage scheme suggested by the Canadian engineers in their conferences with the United States section of the board several years ago. The previous report contemplated a double-stage development scheme with the first stage at Ogden Island, near Morrisburg, and the lower one at Barnhart Island, 2½ miles above Cornwall. Subsequent investigations have led the Canadians in their present report to recommend the alternative project of installing the first stage at Crysler Island, 3 miles down stream from Morrisburg, in preference to Ogden Island. The second stage remains as before at Barnhart Island.

The report recommends that the side canal at Crysler Island be placed on the Canadian side, although it could be built on the United States side at the same cost. The report says that the side

TOWERS NOW NEIGHBOR TREES IN ENGLISH MEADOWS

England's rural beauty is now in some places diversified by man-made towers among the God-made trees, but every effort to leave the landscape undisfigured has been made. The picture shows a section of the transmission line between Bedford and Luton, which forms part of the new electrification scheme.

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canals and locks for carrying deep-water navigation past the Barnhart Island development could be constructed more economically on the United States side, but that they could be built in Canadian territory at an increase in cost ranging from $5,000,000 to $8,000,000.

▼

British Electrification Makes Steady Progress

IT WAS recently announced that the Electricity Commission of Great Britain has sanctioned schemes for extensions to electrical generating plants in England totaling 390,000 kw. The capacity of the County of London Electric Supply Company's station at Barking and that of the Newcastle-on-Tyne Company's station at Dunston are to be enlarged by 150,000 kw. in each case, while the north Metropolitan Company's plant at Brimsdown is to have an additional 50,000 kw. and a further 40,000 kw. is to be added to the London County Council's plant. The extensions will mean an expenditure of about $20,000,000, all of which will be undertaken by British firms.

Possibility of electrification on the Great Northern section of the London & North Eastern Railway, one of the four big British railroad systems, is foreshadowed by negotiations which have just been opened between the L.N.E.R. and the government development act committee for a grant toward the cost of the scheme.

The plans submitted to the committee include the electrification of the main line of the section leading out of London via Hatfield and Enfield as far as Welyn Garden City, 20 miles from the London terminus. Suburban branches covering north London are also included. The total length of line is 60 miles, equal to 173 miles of single track. The estimated total cost of the project is $21,750,000.

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Wilbur Gestures, Work Starts, Las Vegas Cheers

TELEGRAPHIC instructions from Secretary of the Interior Wilbur, issued on Monday immediately after the President had signed the appropriation bill containing $10,660,000 for Boulder Dam, started men working on preliminary jobs connected with road building and site surveys for the contemplated Colorado River plant. Actual construction will, the engineers in charge hope, be begun in three months' time. In the meanwhile job seekers are arriving in considerable numbers at Las Vegas, Nev., the nearest city and coming headquarters, where things are looking up after years of vicissitude.

▼

Planning for National Hydraulic Laboratory

PLANS for the construction of the National Hydraulic Laboratory were discussed by a special advisory committee in Washington on June 25 at the Bureau of Standards. Representatives of all the federal bureaus interested in the work and several prominent hydraulic engineers from other parts of the country were in attendance.

John R. Freeman, whose efforts over a long period of years were largely responsible in shaping the movement culminating in the recent passage of the laboratory bill, presented detailed drawings and estimates. It was his opinion that a laboratory equal to any other in the world can be built with the forthcoming appropriation of $350,000 to

start the work plus $50,000 per year thereafter. On the site provided at the bureau he proposes to erect a large forebay with flumes and a measuring basin capable of circulating 500 sec.-ft. of water at heads up to 40 ft. and measuring the quantities within one-tenth of 1 per cent. Basic theory can be developed on a wide variety of problems now controversible, he asserted, and research can be conducted in such practical problems as dam design and model investigations of river sections.

▼

Power Commission Report —Priest Rapids Project Off

CLOSE of the fiscal year found the primary affairs of the Federal Power Commission in excellent condition, according to a report made public at the commission's offices. The docket has been practically cleared of important applications involving early construction. Pressing cases have been disposed of and the general accumulation from past years has been substantially reduced. Thus the new commissioners who, under recent legislation, will replace the Cabinet officer members in the direction of the commission's activities will have opportunity to become familiar with their task before being called upon to make decisions of moment.

In the past twelve months licenses have been issued for 76 projects of all classes, as compared with 34 projects authorized in the previous year, and the installation of more than 1,000,000 hp. has been authorized by the licenses issued. This exceeds the total net increase of the entire three-year period preceding.

Altogether, in the ten years of its life, the commission has issued licenses for 449 projects. Many of these consist of small generating plants and transmission lines occupying government land, but of the total 104 are of the major project classification. These range from stations of a few hundred horsepower to the giant developments of Niagara and Conowingo. Construction has been completed and operation started in the case of 83 of the 104 projects. Audit of accounts has been made in the case of 55 of the 83 projects so far completed.

As the Washington Irrigation & Development Company was unable to establish prior to July 1 that it would be able to find a market for enough power to justify the installation of 200,000 hp. at Priest Rapids on the Columbia River, the commission has rejected the application of the company for another license. Studies made in connection with the project convince members of the commission's staff that further development of the country in the Priest Rapids region must take place before it can support a project of the size that necessarily must be built to harness the Columbia at that point.

Over the recommendation of its executive secretary, the commission has agreed to hold a hearing to consider a protest by the Yosemite Power Company against a decision by the executive secretary to reject its application for a license for a proposed development on the Tuolumne River in California. The secretary contended that a hearing was given the power company in San Francisco last year and that its side of the case had been thoroughly studied. The application conflicts with one filed by the Turlock and Modesto irrigation districts.

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Revised Dates for Camp Co-operation X

DATES for Camp Co-operation X, ninth conference of representatives of electrical leagues and others interested in co-operative market development work, have been advanced several days, and the conference, which is under the auspices of the League Council, will be held from Thursday, July 31, to Monday, August 4, inclusive. Speakers already scheduled include Ralph Neumuller, G. W. Austen, L. E. Moffatt, J. S. Bartlett, Miss Clara Zillensen, A. W. Berresford, J. E. North, H. B. Kirkland, J. H. Blitzer, G. S. Merrill, F. A. Belden and Earl Whitehorne, all of whom will address themselves to subjects of timely practical interest.

Martinsville (Ind.) Rate Case to Set Precedent

ON THE result of the electric rate case of Martinsville, Ind., against the Wabash Valley Electric Company noted in ELECTRICAL WORLD for April 5 (page 676), which will be tried in federal court on September 2, will depend the fate of more than 70 petitions filed by Indiana cities with the Public Service Commission asking for lower electric light and power rates. The decision in the Martinsville case will set a precedent in law in that the court is expected to determine just what property and what intangible values such as depreciation, good will, etc., shall be taken into consideration in making an appraisal of the value of a local utility plant for the purpose of determining rates. No precedent of this kind, it is said, has ever been set in Indiana and the commission will wait for the decision of the federal court before taking any action on the other petitions for lower rates.

Martinsville's petition to the commission, which set out that the Wabash Valley Electric Company was making a profit in excess of a fair return on its investment in that city, was filed March 16, 1927. After a delay of three years, the commission reached a decision ordering rates which would cause a reduction in revenue for the utility company of approximately $14,000 a year. The Wabash Valley company appealed the decision to the federal court and obtained an injunction permitting it to continue its old rates.

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This trailer, weighing about 3 tons, can handle heavy cable reels exceeding 10 tons. Drawn by a tractor, virtually impossible terrain may be traversed. Only two men are needed for deliveries. Special provisions are made for loading and unloading.

Dominion and Ontario Governments Clash Over Water Power

SHARP differences have arisen with regard to the relative positions of the Dominion government and the Provinces of Ontario and Quebec in the development of power on navigable streams. In a recent speech at Peterboro, Ontario, Premier Mackenzie King made the statement that the St. Lawrence development was being held up by Ontario. A few days later Premier Ferguson of Ontario replied that such a statement was entirely without foundation and was made in an effort to shift the responsibility from the federal Premier's shoulders, where Mr. Ferguson thought it unquestionably rested.

The first public statement outlining the result of the conferences on this matter between representatives of the Dominion and provincial governments in January was given by Premier King in the form of a memorandum during the Peterboro speech. The memorandum set forth the policy which the Dominion government is prepared to adopt as a basis of agreement with the provinces. The principal clauses read:

1. Where a province desires to undertake power development in navigable waters, its right to do so shall be recognized, conditional on the provision of the necessary navigation requirements.

2. Should the Dominion government at any time undertake to authorize the construction of any canal or other work for the improvement of navigation, it would be prepared to make available to an approved provincial agency the surplus water power developed beyond that needed for the operation of the locks and purposes of navigation on a basis equivalent to that which would govern if the provincial agency had itself undertaken the work as a power development scheme.

3. In either case, should the use of Dominion or provincial property be required or the riparian or other property rights of the Dominion or province be interfered with or affected, the acquisition of such property, or the authority to interfere with or affect such rights, could be made the subject of a special agreement in the particular circumstances of each case.

In his reply Premier Ferguson said that the memorandum in question was never submitted to the conference or communicated to Ontario and that it differs in an important respect from the proposal actually put forth by the federal government. "The statement submitted to the conference," he asserted, "was predicated upon the vital condition 'subject to the observance of any necessary international requirement.' This clearly means that the federal government in its international negotiations wants to deal with the property of the provinces in any way it sees fit without reference to the provinces. For example, the actual power development could be placed anywhere in any section of the river either on the American or Canadian side, and the province which owns the power would be precluded from any voice."

In a later speech Mr. Ferguson declared that Ontario is not going to permit its proprietary rights in the water powers of the St. Lawrence River to be made the subject of bargaining between the Dominion government and the United States, though it is willing to take part in an international conference to aid development. It was because the province refused to have its investment of $300,000,000 in hydro-electric enterprises jeopardized by uncertainty or destroyed by confiscation that he had joined issue with Premier King, Mr. Ferguson said. The clause relating to international agreements in the federal Premier's memorandum, he added, was a threat of confiscation.

▼

Northern Illinois Company Cuts Million from Bills

REDUCTION in rates of the Public Service Company of Northern Illinois for residential electric service beginning August 1 has been announced by that company. The new rate, which will, it is estimated, effect an annual saving of more than a million dollars, will begin at 8 cents and be stepped down to 7 cents, 5 cents and 3 cents (net) per kilowatt-hour, except in a few

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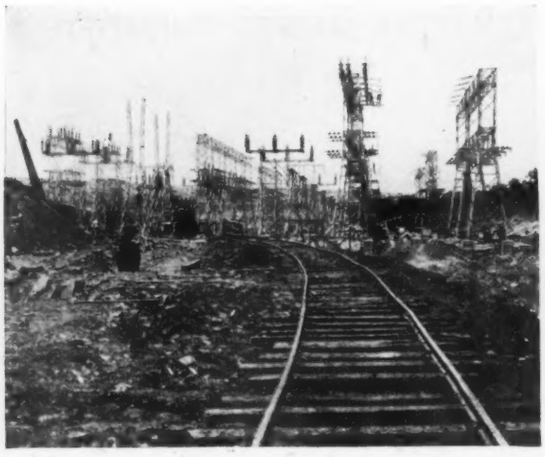
SALUDA DAM FINISHED THREE MONTHS AHEAD OF SCHEDULE



RAPID progress is being made on the 114-kv. substation that will distribute power at the Saluda hydro-electric development being built near Columbia, S. C., for the Associated Gas & Electric System. The substation is about 800 ft. east of the control room in the power house, where four 40,625-kva. generators are being installed. The illustration on the left is from a photograph taken last month.

On the right is shown the last shovelful of dirt being dumped on this great earth dam on June 28. The dam will be allowed to settle for about a year before a highway is built upon it. It is nearly three years since the first shovelful of dirt was deposited. The dam is 208 ft. high and about 1½ miles long and has a width of about a quarter mile at the center of the base. Its completion has beaten the schedule by three months. Water in the reservoir is approaching the halfway stage.

places where the initial rate will be 1 cent higher owing to ordinance provisions. The number of rooms in a home will be the basis of computing the charges, instead of the number of sockets, as at present.

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A.I.E.E. Publishes Two New Standards

THE American Institute of Electrical Engineers has issued new standards covering constant-current transformers of the moving-coil type (No. 12) and air circuit breakers (No. 20). The standards for transformers, induction regulators and reactors (No. 13) and automatic stations (No. 26) have lately been revised. Proposed revisions of the standards for railway control apparatus (No. 16) and for capacitors (No. 18) have been circulated for constructive criticism preparatory to promulgation in definitive form.

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West Canada Utilities Go to Hulswit Company

ANNOUNCEMENT is made that the sale of the Canadian gas and electric properties of the International Utilities Corporation to the American Commonwealths Power Corporation and associated interests, including the American Utilities & General Corporation, has been arranged with the exception of some minor details. Frank T. Hulswit is president of the American Commonwealths Power and the dominant factor in its dealings.

The American Commonwealths Power Corporation will, the announcement says, control more than 60 per cent of the Dominion Gas & Electric Company, which controls Canadian Western Natural Gas, Light, Heat & Power Company, Northwestern Utilities, Canadian Utilities, Union Power Company, Nanaimo Electric Light, Power & Heating Company and certain miscellaneous investments. These companies operate in more than 100 communities in Alberta, Saskatchewan and British Columbia.

▼

Supreme Court Will Hear Alabama on Shoals Tax

THE United States Supreme Court has agreed to pass at its next term beginning in October on the question of whether the federal government must pay a tax to the State of Alabama for power generated at Muscle Shoals. The state contends that the federal government in the development of the hydroelectric power for sale to power companies is engaging in a private business enterprise. Alabama first brought suit in the Court of Claims without consent of the federal government and the suit was dismissed.

▼

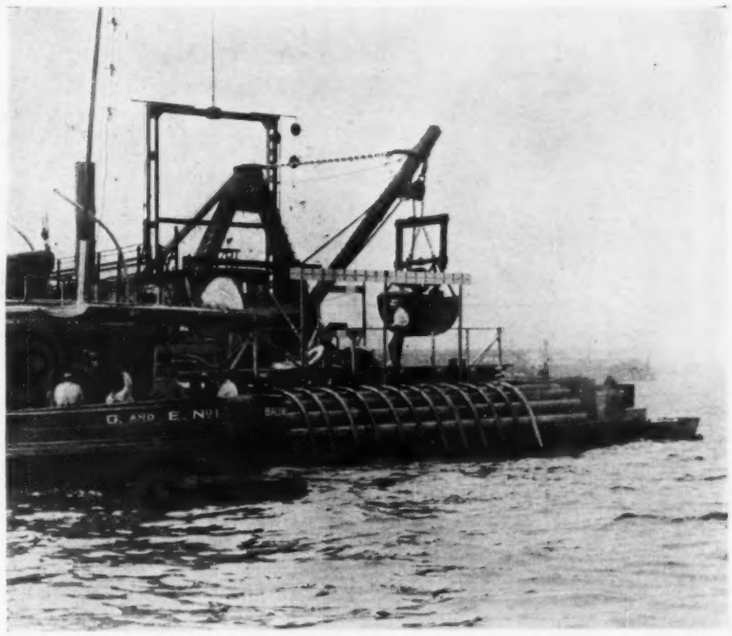
California Cities and Utilities Air Contentions

TWO cases involving disputes between municipal and private utilities have just been adjudicated by the California Railroad Commission. In the first of these the commission ordered the Pacific Gas & Electric Company to deliver electrical energy for all municipal purposes to Redwood City at one point, when the city shall have provided the necessary facilities, at the rates and under the conditions provided in the company's power schedule. The city has hitherto purchased energy for street lighting, general power and miscellaneous purposes at about a dozen separately metered points of delivery. It desires to receive the bulk of its energy at a central point in order that it may receive the benefit of lower charges, and the commission sustained its right to be so served.

The commission, however, dismissed complaints by the city of Fairfield against the Great Western Power Company and by the cities of Mountain View and Stockton against the Pacific Gas & Electric Company. Those municipalities sought an order directing the power companies to supply them with electrical energy for resale over municipally owned distributing systems in competition with the companies furnishing the power. The commission was also asked by the cities to fix the rates to be paid by the cities for such energy.

Commissioners Louttit, Decoto and Whitsell in the majority opinion held that "a careful review of all the facts and circumstances cited by complainants fails to establish the claim that either of the defendant utilities has dedicated its facilities to the use of systems operating in competition with it." Commissioners Seavey and Carr dissented, holding that the companies under their franchises could not refuse to sell energy to the cities that granted them, even though these cities had themselves entered business in competition with the utilities. They saw no confiscation.

LAYING CABLES UNDER BALTIMORE HARBOR



Twelve cables, each capable of carrying 33,000 volts, were on Sunday, June 29, simultaneously stretched under the channel of Baltimore Harbor, 47 ft. beneath the water's surface. They connect the Lazaretto Depot with Fort McHenry, a distance of 1,895 ft. The cables will carry current from the Gould Street and Westport plants of the Consolidated Gas, Electric Light & Power Company to the Western Electric Point Breeze factory. Only three cables will be used at present.

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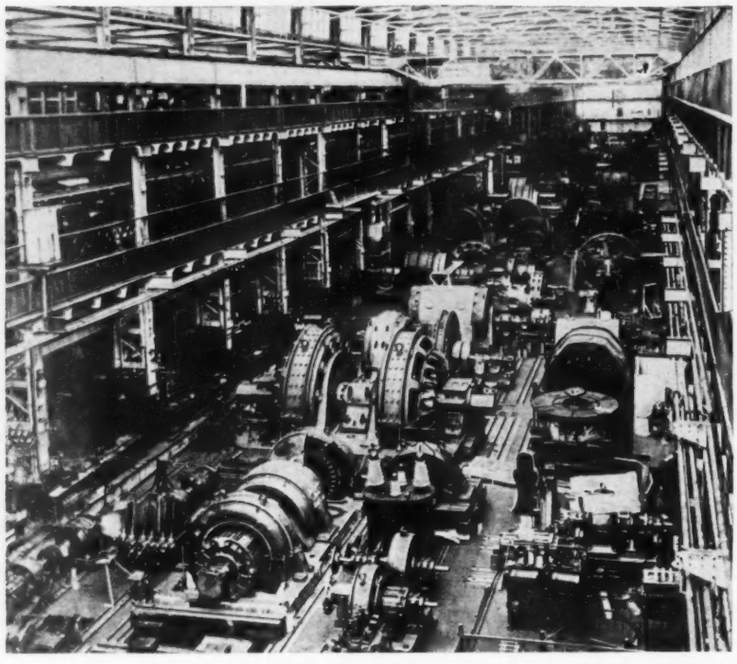
ONE OF BERLIN'S ENGINEERING SIGHTS



—*Wide World Photos*

Among the many plants visited by World Power Conference delegates in Berlin were the Siemens-Schuckert works. The picture shows the inspection department.

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A.S.T.M. Reports on Electrical Materials

AMONG the multitudinous committee reports presented at the annual meeting of the American Society for Testing Materials at Atlantic City in the week of June 23-27 was that of the committee on electrical insulating materials (H. S. Vassar chairman). This committee reported progress on a number of studies being made on insulating varnishes, molded and sheet insulating materials, liquid insulation, radio-frequency tests and on resistivity and power-factor measurements. It also presented a new method for measurement of thermal conductivity of laminated materials, and recommended advancement to standard of tentative methods of testing electrical porcelain and of the tentative revision of standard methods of testing molded insulating materials. Revision of the tentative methods of testing insulating varnishes, laminated sheet insulating materials, sheet and tape insulating materials for dielectric strength and insulating paper was advised.

Another committee (Dean Harvey chairman) reported on electrical heating, electrical resistance and electric furnace alloys. It outlined a test program comparing the life of electrical heater wires in an accelerated life test with that under service conditions and dealing with the effect of atmospheric humidity upon life, procedure for temperature coefficient to resistance and a bend test for determining elastic properties of alloys at high temperatures. The committee reported that specifications for electrical heating wires were in preparation as well as a study on alloys for electric furnace structures and test methods therefor. It presented a new method of test for thermo-electric power and recommended adoption as standard of the tentative method for change of resistance with temperature of metallic materials for electrical heating.

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"Blue Sky" Laboratory for G. E. Company at Pittsfield

A "BLUE-SKY" laboratory where research engineers of the General Electric Company will be able to make tests of transmission-line equipment under natural conditions is to be erected at Pittsfield, Mass. The new outdoor experimental room will be operated as a separate unit from the famous artificial-lightning laboratory, where flashes rated as high as 5,000,000 volts have been produced.

In the new laboratory engineers will not have to wait until equipment is in actual service to find out what wind and rain, storm and sunshine can do to it. All equipment associated with the production and use of transmission lines at high or low voltages can be tested. Three transformers in chain, designed for continuous operation at full voltage, will be installed. In this manner tests may be run outdoors for a considerable time, especially when weather changes are expected. If the temperature should rise considerably in sub-zero weather, insulators might collect considerable deposits of frost, making test conditions of unusual value. Conversely, if warm weather has prevailed, tests of a string of insulators which are gradually collecting a coating of sleet as the temperature drops cannot be obtained. Artificial rain will also be produced in the new laboratory.

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West Virginia Project Approved by Commission

APPROVAL has been given by the Public Service Commission of West Virginia to the development of hydro-electric power on the Cheat and Blackwater Rivers by the West Virginia Power & Transmission Company, a subsidiary of the American Water Works Company. The decision of the commission followed extended hearings in which it was urged that the royalty fixed by law was not sufficient, that it was an economic mistake to develop water power when one of the principal industries of the state was the mining of coal, and that the granting of a license covering thirteen different projects would be monopolistic.

The commission, however, did not sanction all the proposed projects, approval being limited to eight developments for the main stream of the Cheat and Blackwater and five developments proposed for Big Sandy Creek, Glady Fork, Shavers Fork and Dry Fork being excluded. The projects approved include the Blackwater storage development, Blackwater power development No. 1 and Blackwater power development No. 2, all in Tucker County, and, on the Cheat, the Beaver Hole power development, Middle Cheat development No. 1, Middle Cheat development No. 2, Albright development and Erwin development.

The applicant estimates the cost of the initial stage of power development at $2,507,000 for Blackwater storage and $4,037,000 for Blackwater power No. 1 and says that the ultimate development proposed will cost $100,000,000. The estimated ultimate installation in the Cheat hydro-electric project is 500,000 kilowatts.

Southern Sierras Power Not to Have Revaluation

REVALUATION of the properties of the Southern Sierras Power Company, Riverside, Calif., is unnecessary, in the opinion of the California Railroad Commission, which on June 25 issued an order to that effect, after further hearing on the company's application for a revision of its rates. In disposing of the company's request for a revaluation of its properties the commission said:

"It is significant . . . that the company does not desire to charge higher rates than those now in effect to its consumers, and that the sole purpose of the company in filing its application was to use the commission as a means to an end in obtaining a valuation of its associated properties for purposes of financing or other ends. The mere making of appraisals is not a duty or function of this commission. The finding of value is often a necessary incidental to the more fundamental functions of regulation, but the record in the present case clearly shows that the finding of the value of this company's property would be superfluous and unnecessary to a proper disposal of these proceedings and would serve no useful purpose beneficial to the public."

The Southern Sierras Power Company has in the last two years voluntarily reduced its rates by approximately $200,000 a year, and further voluntary reductions to meet competition are thought probable.

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Coming Meetings

Wisconsin Utilities Association—Electric Section, Lorain Hotel, Madison, July 17 and 18. Commercial Section, Green Bay, July 31 and Aug. 1. J. N. Cadby, 105 Wells St., Milwaukee.

Camp Co-operation X—Association Island, Henderson Harbor, N. Y., July 31-Aug. 4. Society for Electrical Development, 420 Lexington Ave., New York.

Association of Electragists International—Hotel Schroeder, Milwaukee, Aug. 18-20. L. W. Davis, 420 Lexington Ave., New York.

International Association of Electrical Inspectors—Northwest Section, Bellingham, Wash., Aug. 25-27. F. D. Weber, 414 Lumbermen's Bldg., Portland, Ore. Western Section, Congress Hotel, Chicago, Sept. 15-18. W. S. Boyd, 175 Jackson Blvd., Chicago. Eastern Section, Pittsfield, Mass., Sept. 22-24. R. Walker, 85 John St., New York.

American Institute of Electrical Engineers — Pacific Coast convention, Portland, Ore., Sept. 2-5; Middle Eastern district, Philadelphia, Oct. 13-15. F. L. Hutchinson, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 3-5. Harold A. Buch, Telegraph Bldg., Harrisburg, Pa.

Empire State Gas and Electric Association—Saranac Inn, N. Y., Sept. 18 and 19; Meter Section, Watertown, N. Y., Oct. 9 and 10. C. H. B. Chapin, Grand Central Terminal, New York.

Great Lakes Division, N.E.L.A.—French Lick Springs, Ind., Sept. 25-27. T. C. Polk, 20 North Wacker Drive, Chicago.

American Electrochemical Society — Hotel Statler, Detroit, Sept. 25-27. C. G. Fink, Columbia University, New York.

National Safety Council—Pittsburgh, Sept. 29-Oct. 4. W. H. Cameron, 20 North Wacker Drive, Chicago.

New England Division, N.E.L.A.—New Ocean House, Swampscott, Mass., Sept. 29-Oct. 1. Miss O. A. Bursiel, 20 Providence St., Boston.

Illuminating Engineering Society — Hotel John Marshall, Richmond, Va., Oct. 7-10. E. H. Hobbie, 29 West 39th St., New York.

Rocky Mountain Division, N.E.L.A.—Franciscan Hotel, Albuquerque, N. M., Oct. 20-22. O. H. Weller, Public Service Co. of Colorado, Denver.

Promotional Rates Help Michigan Utilities

STRESSING the fact that Michigan has won an outstanding position in developing the domestic use of electricity through its promotional rates, bringing in an average revenue of 4.87 cents a kilowatt-hour, President E. L. Edwards of the Michigan Electric Light Association told that body when it assembled at Mackinac Island last week for its annual convention that the electric utilities of the state are in a sound and progressive position despite the lull in business. Although production of electric power for the first four months of the present year was 6 per cent behind the phenomenal first four months of 1929, it was 8 per cent ahead of the like period in 1928, which was a record up to that time, he said.

Mr. Edwards also pointed out that Michigan, because of liberal line-extension policies and rates, is making astonishing progress in farm electrification. Prof. H. J. Gallagher of Michigan State College reported that last year state utilities built 1,227 miles of farm lines and connected 5,359 new farm customers. This year it is expected that fully as much line will be constructed and 6,000 more customers added.

The convention devoted much attention to rates, promotion of sales and merchandising, a number of timely papers on these topics being read. At the opening joint utility session Henry C. Spurr, editor *Public Utilities Fortnightly;* Arthur R. Treanor, editor Sagnaw *News*, and Arthur W. Stace, director Michigan Public Utility Information Bureau, spoke.

D. W. Hayes, Detroit Edison Company, was elected president; D. E. Karn, Consumers Power Company, first vice-president, and George W. Baldwin, Edison Sault Electric Company, second vice-president. Herbert Silvester was re-elected secretary-treasurer.

LINDBERGH BEACON

—*Wide World Photos*

One of the greatest searchlamps yet made will be placed on top of the Palmolive Building in Chicago in August and christened the "Lindbergh Beacon." The artist has anticipated the appearance of this "three-billion-candlepower" light

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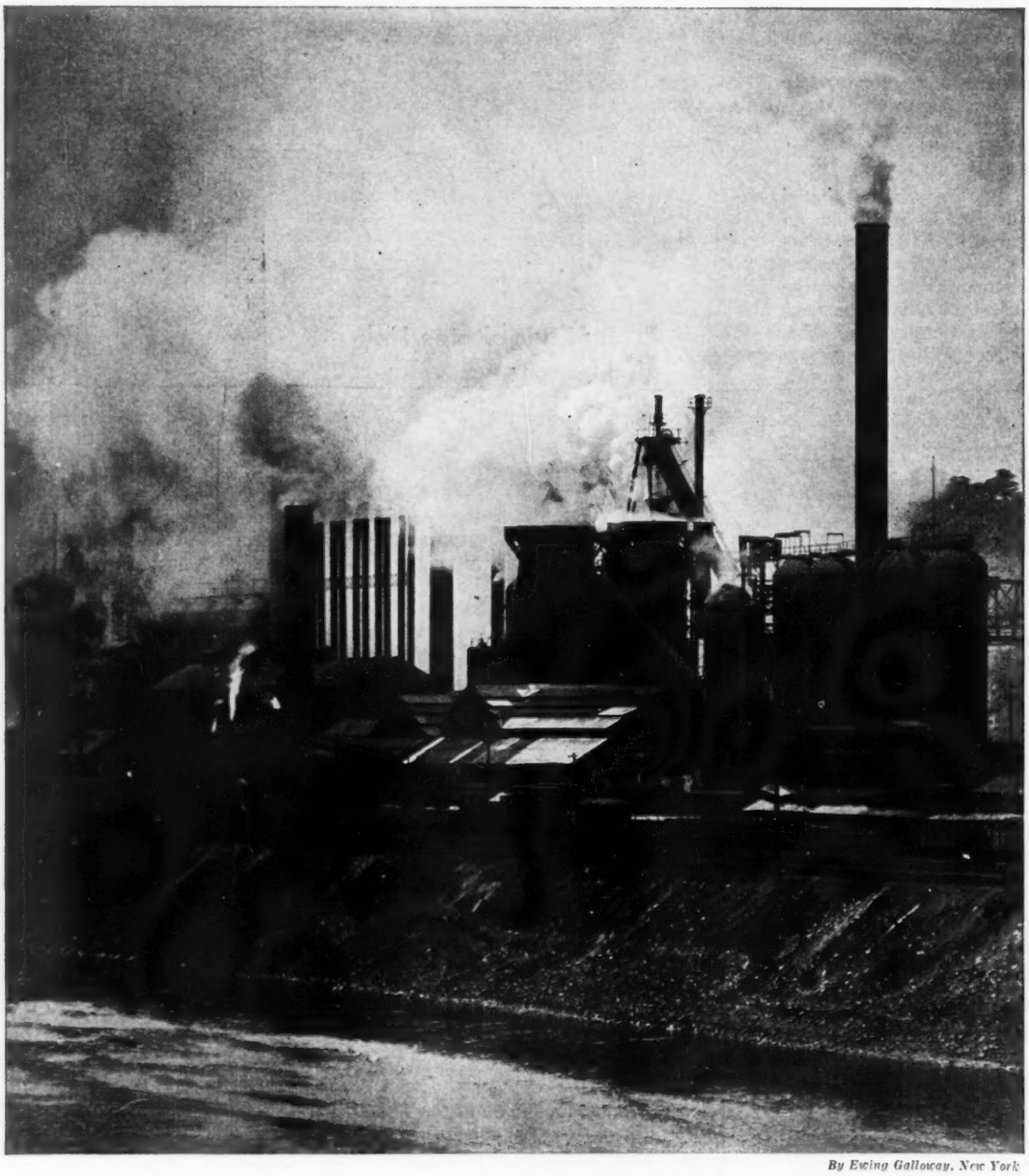
Utility Acquires Hydro Rights of Textile Plant

CONTRACT has been closed by the Cumberland County Power & Light Company of Portland, Me., with the Pepperell Manufacturing Company, Biddeford, Me., owner of textile mills, by the terms of which the former will sell to the latter approximately 12,000 hp. In addition, the power company has agreed to purchase all water power owned by the Pepperell company, as well as undeveloped power and storage sites on the Saco River, the latter including the Union Falls site, where a 25,000-hp. hydro plant has been projected. By this contract the Cumberland County company acquires additional potential power facilities amounting to about 50,000 hp.

An Unanswered Problem



By Ewing Galloway, New York

ASIDE from by-product power producers and large process-steam users, industrial plants are largely purchasing power. How can these remaining plants be interested? Will utilities have to purchase the surplus heat or by-product fuel and resell it to nearby industrials? Can interconnection of these plants by utility lines be made mutually advantageous? Will utilities be compelled to sell heat as well as gas and power? The problem requires undivided attention and study.

EDITORIALS

L.W.W.MORROW
Editor

Clinch the Bases for Cost Allocations

DIDACTIC discussions of the bases for allocation of costs in connection with rate classifications have been plentiful and edifying, and the atmosphere of public sentiment on domestic rates is pregnant with suspicion that expediency keeps practically applied analyses in the background. At the moment the urge for rate adjustments is not great, but preparedness for the future dictates the accumulation of cost data which can help answer the critical questions of the public's rate experts. More and more there appears in the syndicated column the intimation that the voluntary allocation of economies to the domestic rate schedule has been a matter of policy rather than of demonstrable economics. The facts are not difficult of attainment; many of them are being elicited in the load-building and system planning studies generally in progress. It is merely a matter of marshaling the data into new assemblies and supplementing them with other data now missing.

In fact, the whole program of domestic load building hinges largely upon the budgeting psychology of the American middle-class-income family. If its growing electrical expenditures have to compete more and more with its spending for pure luxuries, it is manifest that the competition for the consumer's dollar will be founded on marginal profits in the sales price for electric service. And it is equally certain that these decisions will have to be based more on fact than on fancy as the margins become more elusive. True division of cost all the way from the coal pile to the consumer will need to be known. Undoubtedly the station and transmission costs are of less immediate significance than those from substation to service entrance. The concerted start on the latter analyses should be made now.

Of course, rate making is not a matter of mere cost allocation, but costs are tangibles and helpful in building class business intelligently. In some measure, also, they can help dissipate the clouds that obscure the facts about domestic rate schedules.

Steam Supply as a Builder of Electric Load

DISTRICT heating and steam supply for other uses have been looked upon by some electric utilities engaged in that business as an incumbrance from which they would gladly divorce themselves if they could. Still other utilities that are free from it have declared they are glad they never engaged in this service.

But conditions that determine the financial success of rendering such a service have changed considerably in the last ten years. Business sections in many cities have been transformed from rows of low structures to canyons bordered by higher structures demanding much more steam per linear foot of street than formerly. With this concentration of business has also come a greater appreciation of the value of floor space occupied by heating equipment. Civic pride has increasingly demanded elimination of smoke and street obstructions caused by loading of ash trucks or unloading of coal trucks.

Simultaneously industrial activity in these cities has grown, filling out the gaps between plants around the city or within industrial sections inside the city. Many of these industrial plants require steam not only for heating but for process work. The chief remaining private generating plants are in those commercial buildings and industrial plants which have sufficient use for steam to make generation of power interesting. Even if they can be

interested in purchased power, they still have the problem of steam supply to deter a conversion.

By providing a steam-supply system which can serve such commercial and industrial zones the electric service company would be in a position to furnish both steam and electric service and the biggest objection to purchased power would be removed. While all of these private steam and electric generating plants could not be converted overnight, obsolescence and deterioration of the old plants create a frame of mind that is very susceptible to a change. And, furthermore, provision of both services may be the only means of securing some of the large industrial loads still adhering to private generation because of the large quantities of process steam required.

Average Diesel Costs Misleading

A FINE piece of research work on the fixed charges and operating costs of a large number of Diesel engine installations has just been presented by the A.S.M.E. subcommittee on oil engine power costs. A great deal of valuable detailed information is included, and the percentage of plants reporting complete data indicates that Diesel operators are co-operating in a way that will be much appreciated by every one seeking more definite data on such installations.

But weighted averages are of questionable value, because data on individual installations may depart widely therefrom. For example, the output of three plants recorded represents more than 41 per cent of the total of 36 plants, and these three plants work at high load factors. Again, under attendance labor the weighted average given is a little over 2 mills per kilowatt-hour, but 28 out of 36 plants have a median value of 3.44 mills per kilowatt-hour. Weighted production costs (8.135 mills per kilowatt-hour) also measure low, compared with a median value of 10.534 mills for 26 out of 36 plants.

Would it not be advisable to state the high and low limits for each item recorded to avoid the distortion which a weighted average may produce? Furthermore, it would seem more consistent to express fuel and lubricating oil consumption on the same basis. The figures on fixed charges, one of the items on which there is most debate, are not readily usable because they are not identified with total investments in each case.

Finally, while current operating results are intensely interesting, every student of economics wants to know how a plant performs over a period of years, as some items, like maintenance, increase with years of use.

A Radical Suggestion About Transmission Towers

WHILE various modifications have been made in transmission tower sections adjacent to conductor supports, most operating companies have adhered to the requirement that the towers be highly rigid and self-supporting. But Percy Thomas proposed at the recent A.I.E.E. convention that an entirely different construction using guys may be profitably employed where latitude is permissible in right-of-way width and ground space allocated to the tower.

His tower consists of two posts hinged at the bases and also at the cross-beam. It is not sensitive to reasonably small movements of the small foundations, avoids the necessity of perfect alignments and minimizes the effect of uplift at the foundations. Diagonal guys absorb the transverse stresses and line guys meet the longitudinal stresses. A radical suggestion—but it is of the kind that must be canvassed if the deterrents to reduced system costs are to be circumvented.

Dollars of investment per kilovolt-ampere of installed generating capacity are slowly but surely rising. This is an ominous trend. The consoling feature for the moment is the fact that load factors and utilization factors have been improved and the investment per kilowatt-hour sold shows a slight decrease. The station is to be credited with most of the decreases, but the rest of the system reflects a distressing tendency to stay up and even go up in unit investment costs.

Manifestly the commendable drive of the engineers to insure service reliability over every inch of the path must be tempered with a determination to cut the costs of obtaining it. Viewed as a whole, the problem of reducing transmission and distribution investment may appear defiant of solution. But certain progress will be made if

each element is viewed most critically, even if to the extent of contemplating radical departures in practice. The post type of tower may have its opponents and find limited application. Nevertheless, considerations of capital are rapidly coming to the fore and non-conventional proposals merit more than ever a serious consideration of their proprieties and possibilities.

Is the Generator Bus Doomed?

THE steady increase in sizes of main generating units and accompanying insistence upon greater reliability of performance focus attention upon the place of the station generator bus in the designer's sun. In engineering circles a goodly amount of discussion is now being devoted to methods of simplifying power-plant design, and established features of station assembly are being scrutinized on economic grounds. The convenience of the common bus in regard to load transfer between units has intrenched it pretty firmly in the practice of central-station engineering, but this advantage is gained only at the cost of added equipment for bus connections, supports, bus tie switches, additional reactances and other features.

In some quarters it is believed that the use of a station ring or tie bus defeats its own end by complications in switching and control which are apt to confuse rather than aid the operator in emergencies. Again, in cases where the relays act sluggishly, trouble in one unit among several running in parallel on the common bus may be transferred in effect to others and result in less satisfactory service than where complete sectionalization prevails.

Doubters of the value of the generator bus seem to favor a separation of productive units singly or in groups so arranged that each division is carried through the entire plant independently of the others. Load transfers may be accomplished either at the high-tension terminals of the transformers or at the switching substation of the transmission system. This tendency, at least in certain cases, to do away with the generator bus, *per se*, is receiving further impetus by the remarkable progress being made in load dispatching and interconnection in both regular and emergency service.

It is probably too early to answer affirmatively the question which heads these comments, but there is no doubt whatever that electrical engineering in 1930 is more critical in its scrutinies of design practice than at any previous time. Overhead charges are now seen to be such an important part of total power production costs that time-honored methods of plant design and construction are being analyzed one by one and made to show their usefulness and economic justification, with little regard for precedent. It will be interesting to watch the fate of the generator bus during the coming decade.

Seeing the Atom

IT IS something of a relief to learn from Prof. A. H. Compton, at the recent Ithaca meeting of the American Physical Society, that the latest indications are that the electron is essentially a discreet particle of matter, and to that extent at least it will not be necessary to project ourselves into four (or more) dimensional spaces to understand its properties. This and other important facts about the atom are the results of years of effort by Professor Compton to obtain diffraction X-ray patterns of the atomic structure similar to those obtained by Bragg, Davisson and Sermer and others, by the same method, of the lattice pattern of crystals. The essential difference and the remarkable achievement in the new work lie in the immensely smaller space separation of the electrons within the atom as compared with that between individual atoms.

Foregoing theories of the arrangement of the electrons in orbits, miniature solar systems, cubes, etc., are now upset, and it appears that the electrons surround the positive nucleus in a cloud denser toward the center and with variations of density in accordance with the laws of probability. Just how this picture will account for the regular outer structure postulated by the regularity of chemical combinations remains to be seen, and much further work must be done. It is stated, however, that the evidence is so positive that, to a physicist at least, the structure of the atom can virtually be "seen." It requires no great stretch of the imagination to realize the immense promise of such an instrument for further fundamental and ultimately practical truths.

System Survey Leads to Improved Operation

By J. M. FLANIGEN

Assistant Superintendent Atlanta Division, Georgia Power Company

Georgia Power Company makes extensive study of Atlanta distribution. Methods used in survey. Results of loading transformers. Many improvements made possible

A LOAD survey of the Atlanta distribution system has been completed recently by the Georgia Power Company. The primary purpose of this survey was to secure data for the planning division, but a great many operating conditions were brought to light which made the survey worth while from this standpoint also.

The method followed may be divided according to equipment used into three clases: First, indicated "spot reading" with split coil transformers; second, indicated-demand current readings by means of an ammeter of the heat type; third, graphic meter tests with curve-drawing instruments.

A detailed record of costs was not kept, but an idea may be obtained from the number of men employed and the length of time necessary. The tests were started about the middle of November and carried through until about March 1. During this time 5,443 transformers were tested with the split coils, averaging about fifteen transformers per working day per gang. During the same period tests were made with 50 heat ammeters on 352 transformers.

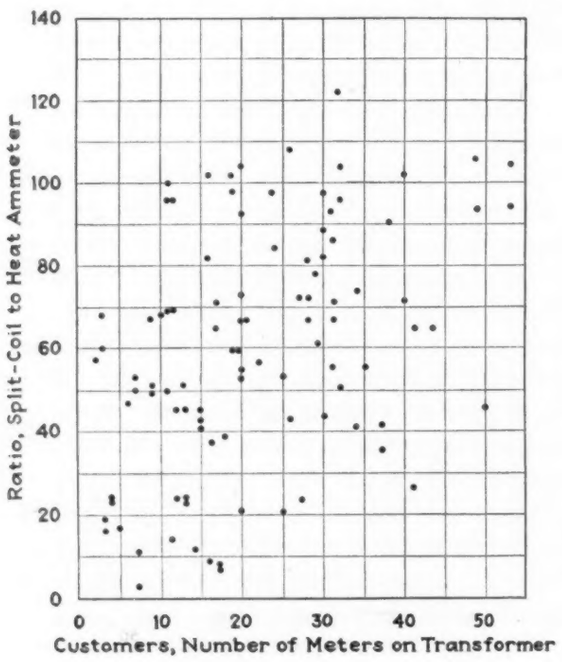


Fig. 1—Comparison of thermal demand and split coil clamp type meter readings show no correlation

The split coil readings were taken by five crews of one lineman and a "test man." These crews worked each afternoon and evening except Sunday and Monday. During the afternoon they would visit the locations to be checked that evening and make all preparations for the evening test, such as skinning leads for voltage readings, etc. These men would work until the peak dropped off.

The "heat ammeters" were handled by a day crew of two trouble men, as the instruments were left on for a period of one week. By installing a few each day it was possible for one crew to devote part time to this work and eliminate the necessity of an extra crew.

This ammeter depends entirely upon the expansion of its element to give the reading. Under full-load condition it takes approximately 30 minutes for the element to expand to full-scale position. The expansion of the element pushes the indicating hand along, but with the load falling off the element returns without the indicating hand. The indicating hand may be reset without removing the cover of the instrument.

These meters are made in 5-, 10-, 15- and 25-amp. ratings, but for 600-volt service only. Therefore, it was necessary to provide some form of case for them, and, in the case of 2,300-volt lines, to insulate them. This was done by reclaiming a number of expulsion fuse wood boxes. The meter was mounted in the box and leads brought out through the bushings.

On the 4-kv. lines the neutral is grounded at each

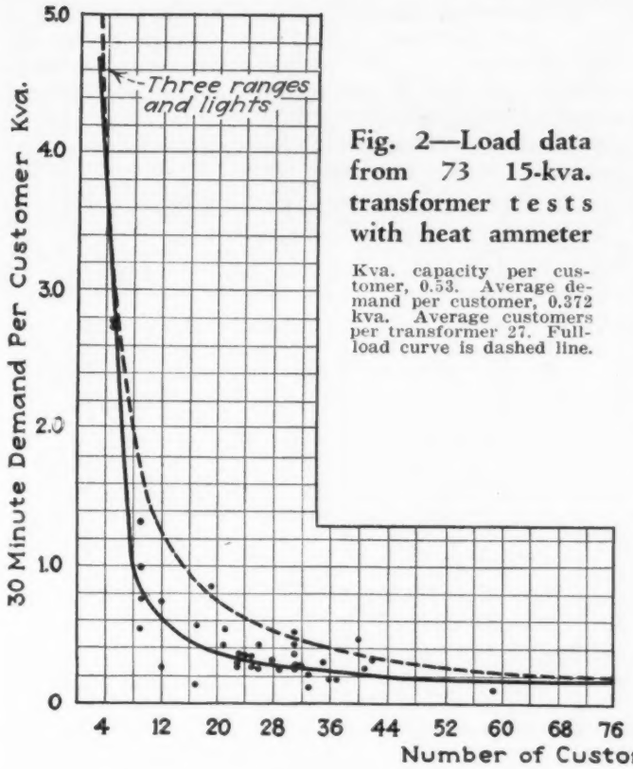


Fig. 2—Load data from 73 15-kva. transformer tests with heat ammeter

Kva. capacity per customer, 0.53. Average demand per customer, 0.372 kva. Average customers per transformer 27. Full-load curve is dashed line.

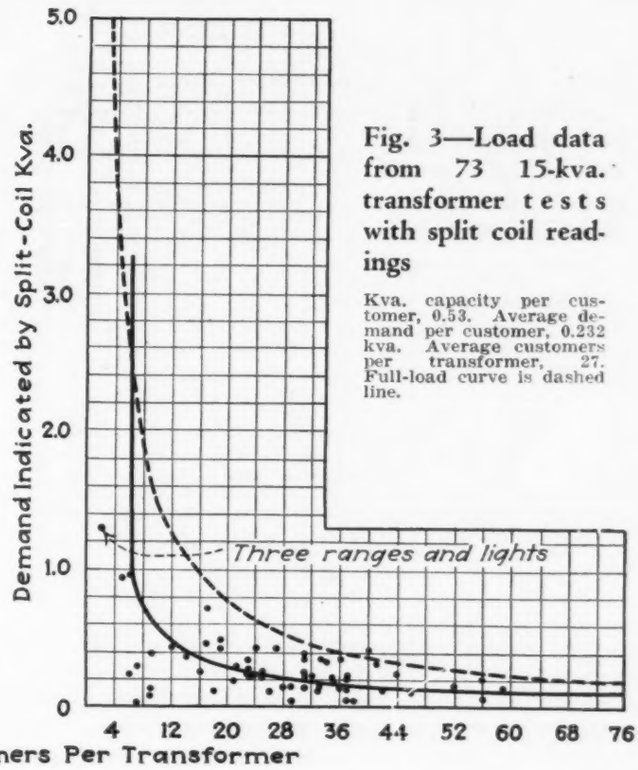


Fig. 3—Load data from 73 15-kva. transformer tests with split coil readings

Kva. capacity per customer, 0.53. Average demand per customer, 0.232 kva. Average customers per transformer, 27. Full-load curve is dashed line.

single-phase transformer installation, therefore by cutting the meter in the grounded leg no insulation was required. However, on the 2,300-volt circuits and 4,000-volt, three-phase installations it was necessary to mount a small porcelain insulator behind the meter. The leads were brought out and equipped with clamps for quick connections.

In passing, it might be well to say that every effort was made to find and use graphic instruments, but we were unable to find one that would give accurate results that was not too difficult to install or too delicate to stand the vibration of traffic and weather conditions. The need for an instrument of this nature is apparent and development by the manufacturers would be of great advantage.

The results of the two methods brought out the fact that the "spot test" is not as accurate as some of us had believed. In fact, the results were so different that we made extensive tests on the instruments to see that they were reasonably correct.

In an effort to determine a relation between the "spot tests" and demand tests we attempted to plot a curve of the ratios against number of services on the transformers. The results are shown in Fig. 1, and the lack of correlation is apparent. One reason for this is brought out in Figs. 2 and 3, where the transformer with three range and lighting customers is indicated. With the spot test the transformer appeared underloaded, 1.15 kw. per customer, but on the heat ammeter test it was just about fully loaded, 4.67 kw. per customer.

Apparently the range load was the direct cause of the poor relation, for it is more evident in these cases. One point for argument was brought out in the summary of the 3-kva. transformer tests: The spot test showed practically all of them underloaded and the heat ammeters indicated overloads as high as 300 per cent rating, yet we did not have a single burn-out of these transformers and very few low-voltage complaints.

In the majority of cases the heat ammeter was higher. There were a few scattered instances where the "spot test" was higher, but very few. These results led us to increase our supply of the heat ammeters, and although we are continuing the spot tests to some extent, we put more dependence in the demand test.

At the same time that these tests were being made we had several district tests under way. These were made by installing a graphic meter on a group of transformers supplying a certain area. At the same time graphic meters were set on customers' premises in the area.

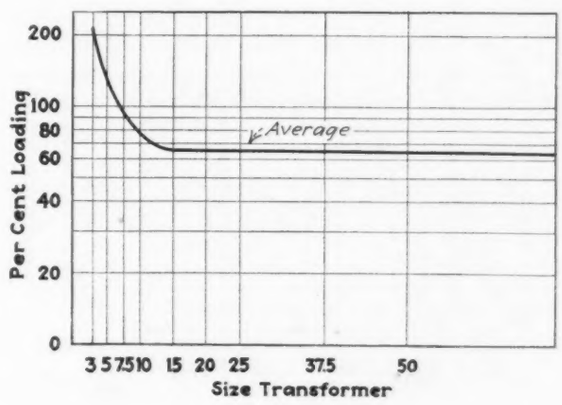


Fig. 4—Average transformer loading in per cent of rated capacity

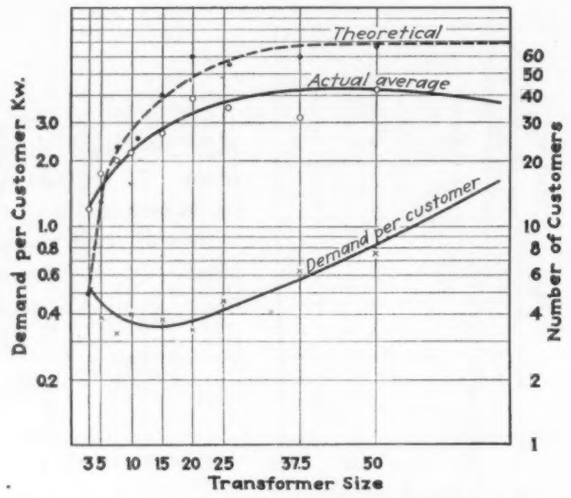


Fig. 5—Average transformer demand per customer and average number of customers per transformer

These latter tests are very valuable, but unfortunately cannot be made as often or completely as desired, as the customer is inconvenienced to some extent. A modification of this test may be made by a totalizing meter and a meter on each transformer. This also gives some interesting information.

Results of transformer tests

A summary of the tests on 73 15-kva. transformers, chosen at random, as representative of average conditions, are shown in Figs. 2 and 3. The full-load curve is obtained by dividing the transformer capacity, 15 in this case, by the number of customers. It will be noted that we can increase our loading and still be within the safe loading of the transformer.

The per cent loading is shown in Fig. 4 and is taken from the summary obtained in plotting curves similar to curves in Figs. 2 and 3 for each transformer size. If we can raise this figure from 70 per cent to around 100 per cent the results would be well worth while. We hope to raise it until the feeder demand equals the transformer capacity connected.

In Fig. 5 is shown average curves that may not be followed very closely, but they do give the average demand per customer and average customer per transformer. From these figures we have derived the "theoretical number of customers which may be put on any transformer." Here, again, is food for thought as to how close we can approach the full-load line.

A "theoretical diversity curve" is shown in Fig. 6 and is made up from graphic charts obtained from customers' premises. The one-half hour peaks occurring from 5 p.m. until 8 p.m. were set down for each customer and then totaled, giving the arithmetical sum of the one-half hour demands. Next the maximum peak occurring during the same period of each chart was picked and a total obtained. Thus we had, in effect, the diversity that would have occurred had these customers

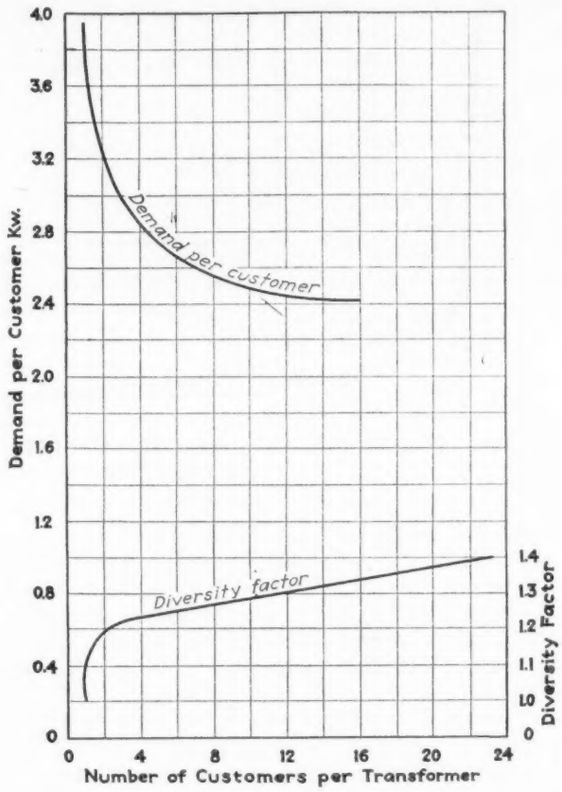


Fig. 6—Average 30-minute demand per customer and diversity factor in high-class residential sections

been connected to one transformer. By working the 32 charts in this manner and combining them in various combinations an average figure was derived. These charts were taken from a high-class residential area, where the loads are heavy and hours' use long. Therefore we do not get the same diversity, nor demands per customer, shown in the other charts.

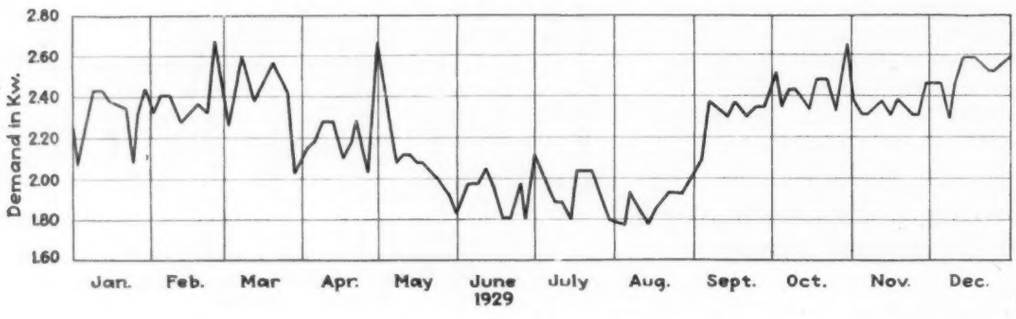


Fig. 7—Feeder demand for customer in high-class residential section

Half-hour demand. Average hours' use of peak demand throughout the year, 6.35 hours per day. Transformer capacity connected per customer, 6.6. Average annual kilowatt-hours per customer, 4,571.

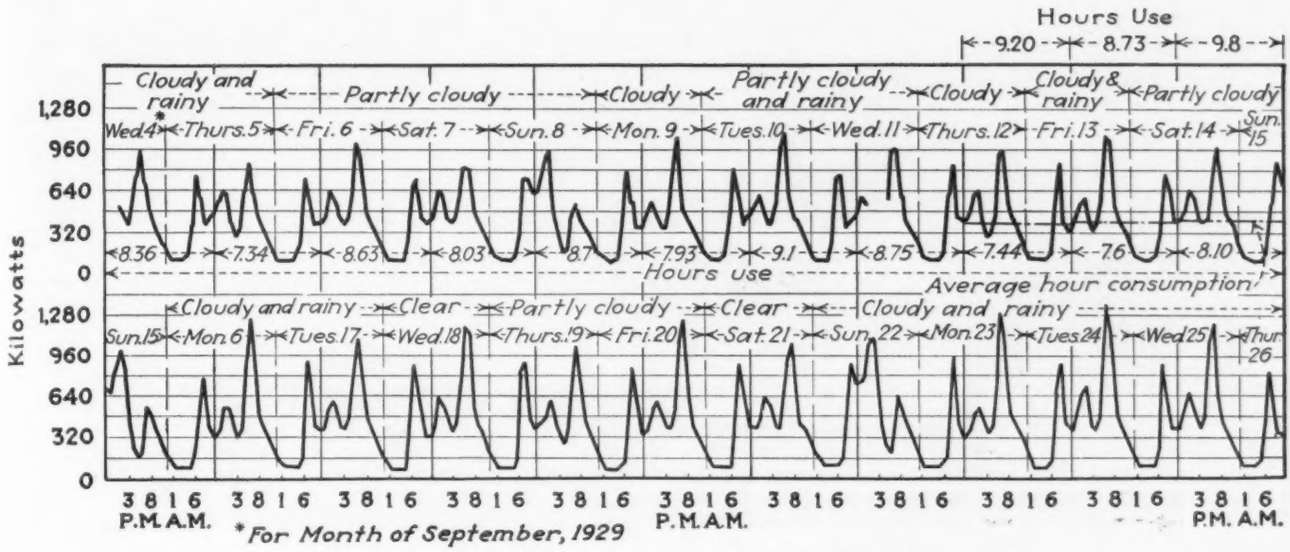


Fig. 8—Feeder chart in high-class residential area

Curves show maximum half-hour demand, average hourly consumption and hours' use of demand.

The data from a district test that has been under way for a year and a half are shown in Fig. 7. Each house has at least one range and water heater, and the lots are large, giving us very few customers per transformer.

A feeder chart of a good residential area is shown in Fig. 8, and gives an indication as to why our spot tests were not so good. The peak, although occurring practically every evening, also appears at other times, notably around 7 a.m. The range is responsible for this and strengthens our belief that it is the cause of the difference in readings. Another point of note is the absence of the Tuesday peak, so noticeable in other parts of the country.

Range load characteristics

In connection with our range load, we are unable to give any particular data. We have better than 5,000 connected to our lines and they are so intermingled with other load that we have not been able to isolate enough of them to get good data. We have found the loading worked up by the N.E.L.A. overhead systems committee several years ago very accurate. We have cases of one range on a transformer and up to a maximum of 50 ranges on one transformer. Practically all new apartments are wired for range and refrigerators and we have to depend upon tests to make sure that we have capacity available. A few typical cases are as follows: Three ranges on a 15-kva. (curves 2 and 3) 4.65 kw. per customer; six ranges on a 37.5-kva., in high-class area, 9.3 kw. per customer; same territory and on another 37.5-kva., six ranges 4.86 kw. per customer; nine ranges on a 37.5-kva., 1.25 kw. per customer; seventeen ranges on a 37.5-kva., 1.6 kw. per customer; eleven ranges on a 50-kva., 1.25 kw. per customer; twelve ranges on a 25-kva., 1.56 kw. per customer. As a general rule, after getting over three or four ranges per transformer, one to two kilowatts is thought to be ample.

The survey provided the data for the planning division and gave us the above information for laying out our secondary system. In addition to this, undesirable conditions were revealed, such as poles broken, defective bushings, leads grounded to case, transformers without oil, and a great many other undesirable operating conditions.

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Safety—An Operating Responsibility

By W. R. LOYD

Alabama Power Company, Birmingham, Ala.

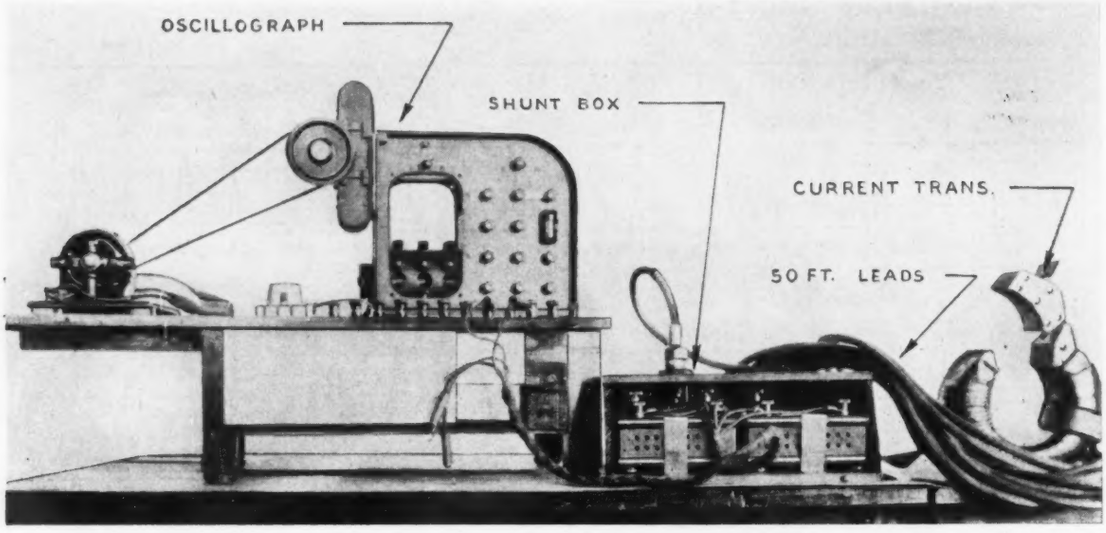
OUR safety department was organized in 1917 and for several years considered that it was responsible for every accident that occurred. Apparently the whole organization felt the same way about it.

Realizing that safety meant efficient operation, it was concluded, after a conference with the management, that each manager and superintendent should assume responsibility for every accident that occurred to the employees and to the public under his supervision. Some of them resented the idea, and it was only after a great deal of correspondence that we were able to get these men to see that their safety work was just as much a part of their duties as the operation of our plants and properties.

The correspondence between this office and one of the superintendents was very illuminating and the only way that we ever reached him was by asking him if he were not responsible for his mechanical equipment. Then we had to convince him that his investment in men was far greater than his investment in appliances.

The result of shifting this responsibility has been most gratifying. In the plant where the superintendent objected so strenuously to taking over this responsibility accidents have been reduced to a minimum. The shifting of this responsibility did not stop all accidents, but the effect has been to reduce accidents everywhere.*

**As indicated in a report of the accident prevention committee of the National Electric Light Association.*



Currents from 1 to 3,000 amp. quickly measured with this portable apparatus

Split-Core Transformer Gives Flexibility to Oscillograph

By FRANK E. JOHNSON
New Orleans Public Service, Inc.

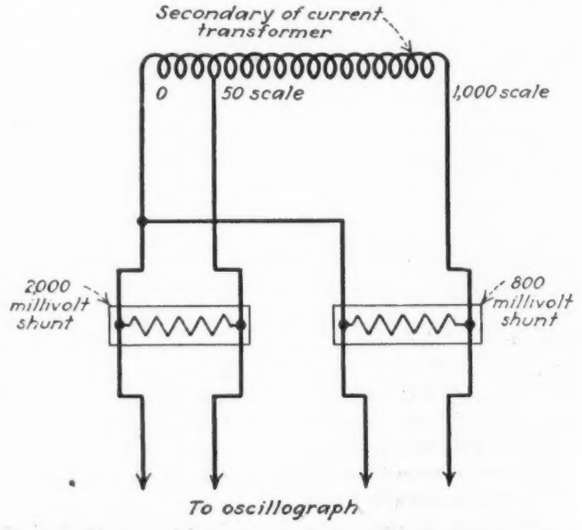
THE operation of a portable oscillograph in the field may often involve considerable time and trouble. This is especially true when it is necessary to measure line current. In employing the usual type of current transformer the line conductor must be cut and the transformer inserted therein. Furthermore, where separate tests at any one location may result in widely varying current values it is necessary to have several current transformers at hand.

In order to eliminate much of the above difficulty and at the same time to reduce the amount of work necessary in preparing for a test, as well as to calibrate the results, a split-core current transformer and a pair of shunts, as shown in the accompanying illustration, have been used with much success by the New Orleans Public Service, Inc. In measuring the line current it is necessary only to connect the proper shunt in series with the correct resistance unit in the vibrator circuit of the oscillograph and then clamp the transformer around the line conductor. This is especially convenient when measusing motor-starting conditions, since it is unnecessary in almost all cases to disturb any of the connections to the motor or starting box. The whole set-up for the test can be arranged in five minutes. Where two line current values are to be measured it is, of course, necessary to have two such sets of equipment as described.

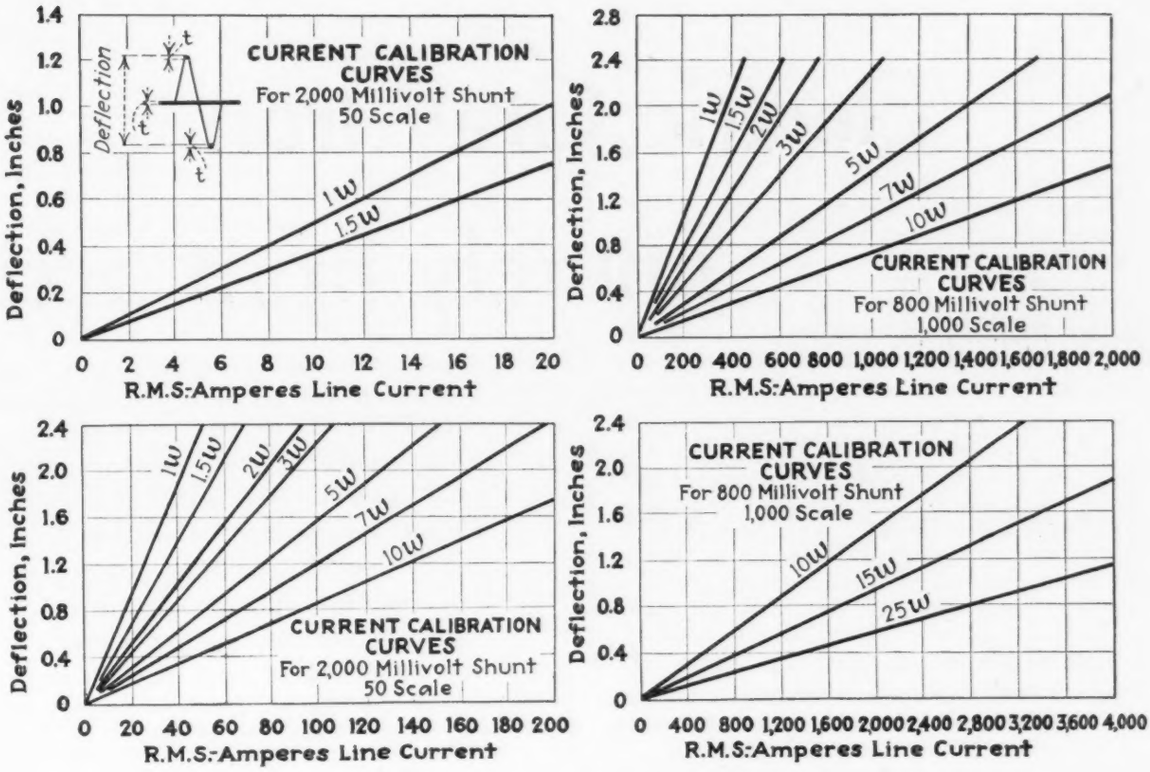
The accompanying diagram shows the connection of the current transformer, the two shunts and the oscillograph. With 800- and 2,000-millivolt non-inductive shunts it has been found possible to measure with commercial accuracy line currents ranging from 1 to 3,000 amp. alternating current on grounded neutral systems up to 4,000 volts. Values up to 75 amp. are measured with the 2,000-millivolt shunt in the circuit; the 800-millivolt shunt is used for currents above this amount. With additional insulation on the current transformer it could doubtless be used on considerably higher voltage lines. The oscillograph current and the vibrator deflection are proportional to the voltage drop across the shunt and, hence, proportional to the line current.

The results of tests are calibrated from curves made up by laboratory checks of the instrument assembly. In conducting a test it is necessary to estimate the amount of current expected, then to choose the proper shunt and such a value of resistance in the oscillograph circuit from one of the curves as will produce the desired deflection on the recording film. The exact deflection may then be measured on the film, and by referring to the curve used the exact current value is determined. This eliminates all computations, excluding many possible sources of error.

To avoid wasting films in securing the calibration



Shunt connections in transformer secondary



Wide current range indicated in portable oscillograph calibration curves

curves in the laboratory the film (six-exposure kodak film) is driven at a slow rate in a long film holder and stopped immediately after being exposed to a particular current value. In this way as many as a dozen or more "shots" may be recorded on one film. Only two or three current values are necessary for each oscillograph resistance value, since the calibration curves are straight lines.

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Periodic Maintenance Avoids Major Troubles

By F. W. EVANS
Supervisor of the Service Department, Westinghouse Electric & Manufacturing Company

EFFICIENT maintenance of rotating apparatus demands frequent cleaning and inspection of parts subject to the accumulation of dirt, oil and other foreign substances and periodical overhaulings in which the apparatus should be disassembled to permit a very thorough inspection of the internal parts of the machine.

For a motor a good rule for effective and efficient maintenance is, "Inspect the equipment once each month and overhaul it once a year."

The monthly inspection should reveal the necessity for removing any surface collection of dirt, dust, oil, sludge, chips of wood or steel and other foreign substances and any need for minor adjustments which if made will prevent having to make major repairs. It should determine whether or not bearings are being lubricated, brushes are long enough to reach the commutator, shunts are tight and brushes are free to their holders. The inspection should also indicate the firmness of couplings, frame or foundation which may have become loose due to excess vibration.

The yearly overhaul is a major maintenance operation. At this time the disassembled parts of the apparatus should receive a thorough inspection and should be properly cleaned and refitted to the machine to assure another year of satisfactory performance and continuity of service.

The inspection made at the time of the yearly overhaul should overlook no detail. With a motor, the commutator should be placed in a lathe and checked for eccentricity, the face should be ground and polished, undercut slots between the bars should be cleaned and, if necessary, re-undercut to insure good commutation throughout the following year. Windings should be carefully washed with one of the several good compounds used for this purpose and then wiped dry. Possibly a few hours of baking at 90 deg. C., if an oven is available, will be desirable. The windings should then be painted with an insulation type of varnish to seal the pores of fibrous insulation materials, thereby preventing the entrance of oil and dust.

Bearings should be checked by the mechanical department and badly worn bearings replaced. Expenditure of a few dollars at this time may prevent a major repair of considerable magnitude. Oil reservoirs should be wiped out or flushed with kerosene. Bearing journals should be polished to remove any roughness or scratches that shorten the life of bearing metals.

Electric Gray Iron Entirely from Scrap

By N. L. TURNER

*Metallurgist Beach Foundry, Ltd. Ottawa, Canada.**

IN THE plant of the Beach Foundry, Ltd., producing stove parts, a point was reached where, with cupola melting, it was necessary to extend floor space to take care of the production. By installing an electric furnace for melting, a continuous flow of iron was obtained and the need of extra floor space for the day's run of molds was overcome. This increased production per floor and decreased the cost of molding equipment. At the same time, by use of all scrap metal, the cost of iron at the spout has been reduced, production increased 25 to 30 per cent and the flexibility of the method has proved very valuable in speeding up production and coping with rush orders.

FOR the past 21 months a 3-ton electric melting furnace has been in successful operation at the plant of the Beach Foundry, Ltd., of Ottawa, Canada, whose manufactured products of coal and wood stoves, furnaces, gas and electric ranges are sold throughout Canada and British possessions. This is the first installation in America of an electric furnace as a melting unit for the production of stove-plate castings.

A point had been reached at which, on cupola operation, where melting was not continuous, it would have been necessary to extend floor space materially in order to cope with the production necessary for the ever-increasing business. As 20 to 30 tons were not considered high enough tonnages to merit continuous cupola operation, a more adequate means had to be devised. After due consideration it was felt that an electric furnace as a melting unit would be the most feasible way to accomplish the desired end.

Advantages of continuous operation

After 21 months of successful operation it may be said safely that the original objectives have been attained and, through improvements made in practice, that the electric furnace has proved to be an ideal melting unit on this class of castings. There are at least three distinct advantages which have been gained by continuous operation, as follows:

1. Production of castings has been increased 25 to 30 per cent under existing conditions, without sand-conveying equipment and working only one shift a day.
2. The cost of iron at the spout is considerably less than previously obtained with the cupola.
3. The flexibility of the method has proved very valuable in speeding up production and coping with rush orders.

The superiority of the electric furnace as a melting unit is forcibly displayed in its capacity for handling charges that could only be melted in the cupola with heavy losses. It is the practice to melt approximately 40 per cent of cast-iron borings, which are an economical and a low-loss raw material. Cast-iron borings in the district can be purchased at a much lower price than other scrap metal and, with the necessary additions of ferrosilicon, ferrophosphorus and ferromanganese, can be converted into a high grade of gray iron at a much lower cost than previously could be obtained with cupola iron.

The disposal of steel clippings from the sheet-steel department formerly caused a considerable amount of trouble, for the expense of baling and shipping rendered them valueless, forcing disposal of them to the simple expedient of dumping them on the scrap heap. However, with the installation of the electric furnace it is possible to treat them as a raw material, making them part of the first charge. It is inadvisable, however, to melt them in large quantities, owing to their tendency to reduce the carbon content.

For the 21 months of continuous operation we have not used a pound of virgin pig iron in our charges, producing at the same time a better quality of gray iron than that obtained in the cupola, where a high percentage of pig iron must be used. Of course, one of the deciding cost factors is the power. In districts where power can be obtained at a reasonable rate the cost of iron at the spout would be lower than that of the cupola. In any case, however, at equal cost, a considerable saving is effected through outside conditions. It may be added, however, that kilowatt-hour consumption per ton is higher under continuous operation than batch melting. The cost summary in the accompanying table, taken off

**Presented at 1930 convention of American Foundrymen's Association.*

our figures for a typical month, show some interesting details.

To maintain the continuity of the operation, an initial bath of iron must be built up before the continuous charging and tapping may begin. After the last iron is tapped out, the pits are cleaned, the furnace bottom is patched and the first charge—consisting of gangway pig, foundry returns, stove-plate scrap, cast-iron borings and steel clippings—is charged into the furnace. At a fixed time the melters come on duty and commence to melt down the first charge, consisting of 3 tons. On completion of this operation and when the iron is up to temperature, the furnace is slagged off and more borings are fed in, in suitably sized charges, until a bath of 9 tons is built up. In the feed charges a division is made and two separate piles are placed, one on each side of the charging door, so that the melter and his helper can feed them into the furnace without loss of time.

Table of Costs—Operation of Electric Furnace for One Month

Raw Materials	Lb.	Cost per Ton	Total Cost	Total Cost per Ton
Stove plate	102,095	$12.50	$637.50	
Borings	234,450	10.00	1,172.50	
Steel scrap	27,455	.....	.....	
Foundry returns	323,285	13.00	2,100.80	
Additions	8,290	.....	.....	
Total	695,575	.....	$3,910.80	$11.25
Additions	**Lb.**	**Cost per Lb.**	**Total Cost**	
Fe Si	6,350	$0.03	$190.50	
Fe Mn	750	0.04	30.00	
Fe Ph	1,190	0.06	71.40	
Coke	13,200	0.006	79.20	
Total	21,490	.....	$371.10	1.07
Labor			397.72	1.14
Power			1,825.55	5.25
Electrode			.....	2.09
Refractories			.....	0.60
Water			.....	0.11
Laboratory			.....	0.50
Interest on investment and depreciation			.....	0.57
Melting loss			.....	1.13
Total cost of operations, per ton			.....	$23.71

On completion of the melt-down of the original bath a test bar is poured and a complete analysis is taken before any iron is tapped. This enables the metallurgist to correct any discrepancies in analysis and to maintain a constant quality of iron. When the iron is passed by the chemist and is up to temperature—the temperature being taken by an optical pyrometer—the first ladle is tapped out. The first bull-ladle of iron is usually tapped out at 7 a.m. to pour off any molds that have been left from the day before or any overtime molding accomplished the previous evening. Sometimes it is necessary to tap out several bull-ladles in succession, to meet with shop requirements, but this serves to stress the advantage of the flexibility of the system in providing iron at any time. After a tapping has taken place a feed charge is charged in, and this operation of tapping and feeding is continued until the necessary amount of iron is obtained for the day's cast.

The usual feed charges under present requirements consist of approximately 1,100 lb. of iron, which takes from fifteen to 30 minutes, depending upon the power input. About 1,400 lb. of iron is tapped out. This, however, depends upon shop requirements. The minor operations, such as daubing the bull-ladle, repairing the spout and grinding the coke, are taken care of by the melter and his helper, who can attend to these in conjunction with the original melt-down. The bull-ladle is heated up in the morning by means of a gas blast before any iron is poured into it. This obviates chilling the iron by means of a "green" ladle.

The shop is divided up into pouring stations, the bull-ladle going to each station according to schedule, or as desired. The stations are signaled by means of a whistle at the furnace, so that the molders and shaking-out crew designated to that station will be ready for iron. A careful temperature control is kept throughout the day. Every bull-ladle of iron has to pass the temperature test before it is conveyed to the pouring station. The ability to control the analysis produces a grade of iron which is almost unvarying in its consistency.

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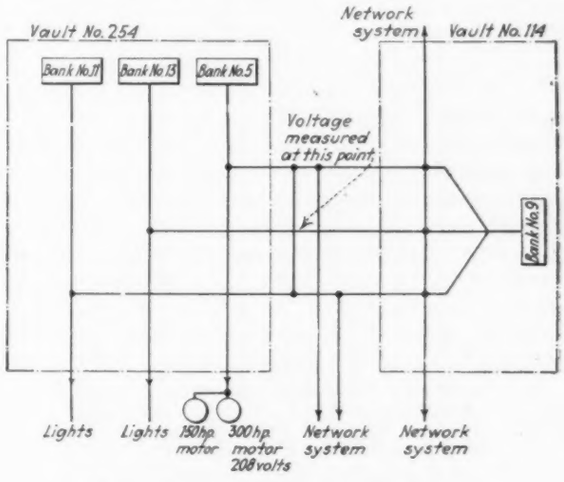
Motor Starting on Networks

TESTS made by a member company of the Southwestern Division, N.E.L.A., and reported by the Engineering Section of that division indicate that a synchronous motor, rated in horsepower at one-third or less of the adjacent transformer capacity figure in kva., can be started directly across the line without objectionable voltage dips.



Location of motor in network

Motor, 300-hp. synchronous; transformer capacity, 1,200 kva., four banks; starter, none; other load at time of test, approximately 100 kva. each bank; location of nearest banks, 200 ft.; test I = all banks energized; test II = bank No. 5 de-energized; test III = bank No. 9 de-energized; test IV = banks Nos. 5 and 9 de-energized.

	Tests			
	I.	II.	III.	IV.
Duration of transient period (in sec.)	65	80	75	90
Maximum motor current amperes (estimated)	1,700	1,700	1,700	1,700
Maximum rate of change of current amperes/sec.	Over 600	Over 600	Over 600	Over 600
Minimum voltage at tie between banks	204	202	204	200
Per cent voltage drop at tie between banks	2.8	3.8	2.8	5.2
(Voltage at switchboards are practically same as at tie)				
Lamp flicker	Practically none	Very slight	Practically none	Distinct

How Catawba Plants Utilize Entire Flow

By S. T. HENRY
Spruce Pines, N. C.

Some of the water used ten times in 1,050-ft. fall. Despite extreme annual and seasonal variations in rainfall storage equalizes flow and permits annual output of 1,400,000,000 kw.-hr.*

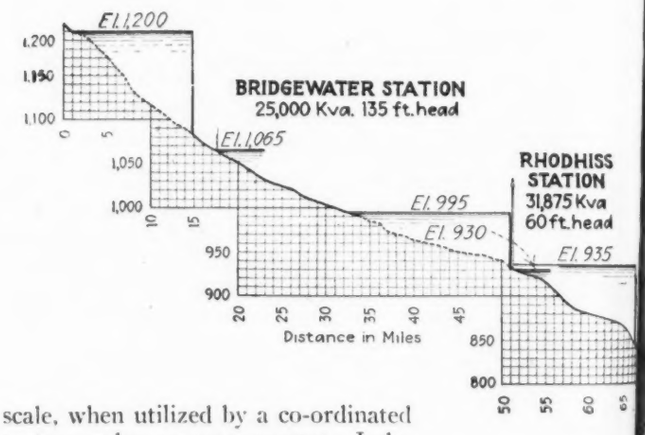
STREAM-FLOW conservation and development on a vast scale, with almost complete utilization of the potential power possibilities, is accomplished by the storage reservoirs and hydro-electric projects of the Duke Power Company on the Catawba River in the Carolinas. The great dams on that stream create storage reservoirs having a combined superficial area of more than 55,000 acres, or 85 square miles. When these reservoirs are drawn down only to the limit where the efficiency of the waterwheels which they serve is maintained, they render available from storage nearly 35,500,000,000 cu.ft. of water. The total useful storage available approaches 42,000,000,000 cu.ft. The location of the reservoirs on the stream also is such that nearly 35 per cent of the total storage passes through all of the twelve power plants of the system. The remainder of the total effective storage volume is utilized from one to ten times on its way down the stream.

Until a few years ago the Duke system depended mainly for power generation on hydro-electric developments on the Catawba River. With the almost complete practical utilization of that stream and the need for auxiliary power, the expansion of generating facilities has lately been chiefly in steam stations. The rapid progress in the art of steam station design also has been a contributing factor in shaping the policy of the company in that direction.

While it appears likely that future power-source expansion of the system may be mainly of steam stations, the hydro-electric developments evidently will long continue to be the backbone of the system. It further is probable that additional hydro-electric developments may be feasible on the Catawba.

At present the Duke system has generating equipment rated at a total capacity of 1,350,000 hp. Of this total nearly 600,000 hp. may be furnished by the water-power plants, of which all except 31,600 hp. are on the Catawba River.

The Catawba River above the furthest downstream of the ten dams, at Wateree, S. C., has a drainage area of some 5,000 square miles. Few streams anywhere within highly developed industrial areas offer such economical opportunities for the development of power on so vast a scale, when utilized by a co-ordinated system under one management. Independent plants would utilize but a fraction of the total made possible by the Duke system and its auxiliary steam plants. This is chiefly due to the wide range in the flow of the river caused by the character of the watershed and by the uneven distribution of the rainfall on the latter. In the 210 miles along the river from the reservoir near Bridgewater to the Wateree development the fall is about 1,050 ft. Most of this drop occurs in such a way as to render utilization of it practical.

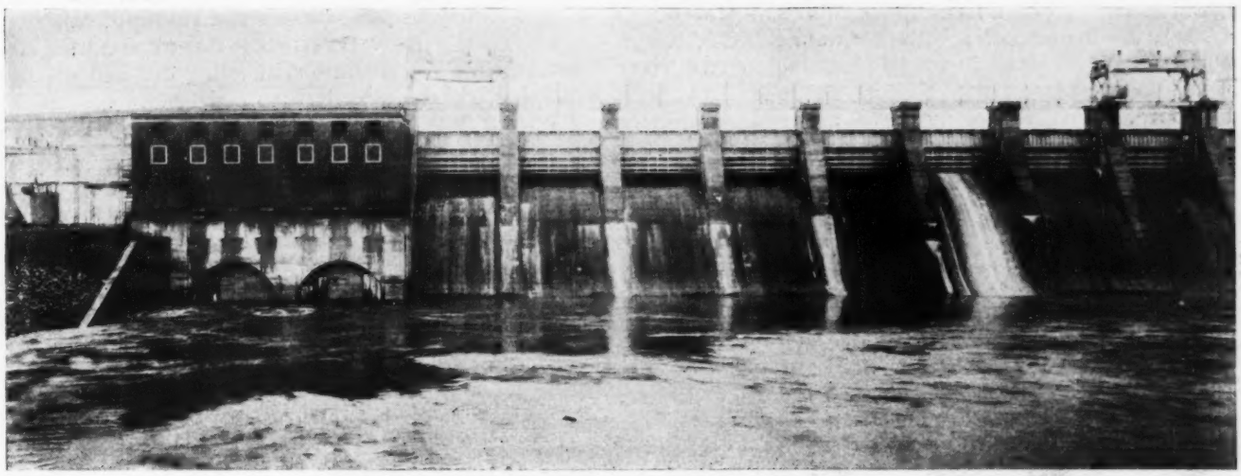


Generally speaking, the watershed of the Catawba River enjoys a large annual rainfall. This is seriously lacking in uniformity of distribution, either through the year or from year to year.

Averages accumulated over from 30 to 40 years on the watershed show a wide variation from the furthest downstream development at Wateree to the crest of the mountains. These means range from 45 in. per year at Wateree to more than 70 in. in small areas in the mountains. Most of the upper reaches of the watershed have, however, in excess of 55 in. of rainfall per year.

Accompanying graphs show the total rainfall by months for ten years at the farthest downstream development at Wateree and at the farthest upstream dam at Bridgewater. It is noteworthy that at Bridgewater a total of

**The Oxford plant was described in "Another Step in Catawba River Development" in the issue of September 8, 1928.*



Latest type of flood control gates and operating mechanism at Oxford station

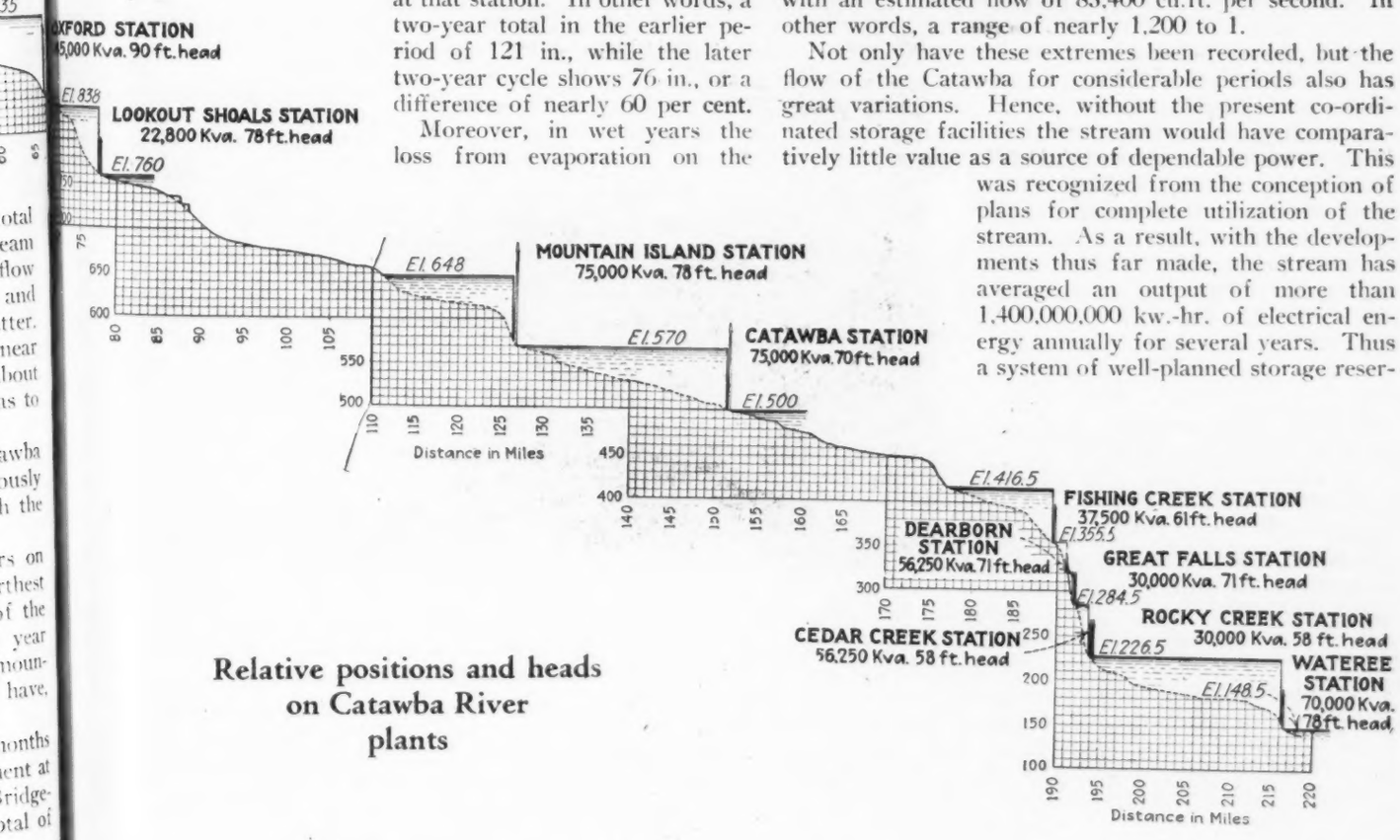
13.35 in. in August, 1920, was followed by 0.3 the following October. The variation between August, 1928, and November of that year is 9.1 and 0.8 in. Similar ranges have occurred at Wateree, 15.71 in. in August, 1928, and 1.3 the next month.

These month-to-month extreme swings are serious. But of more difficult solution is the provision of storage to equalize the year-to-year and even the cyclic ranges of precipitation. For example, at Bridgewater in 1925 only 33 in. of rainfall was recorded, with but 43 in. the following year. In 1918 there were 62 in., and in 1919 more than 59 in. of precipitation at that station. In other words, a two-year total in the earlier period of 121 in., while the later two-year cycle shows 76 in., or a difference of nearly 60 per cent.

Moreover, in wet years the loss from evaporation on the watershed and from the reservoir ponds is far less than in a dry period. The depletion of ground water in the watershed during a long cycle of dry weather has further been found to be a very important factor.

Under these conditions there is a wide variation in the flow of the Catawba. For example, the minimum flow of record of the three tributaries feeding the great storage reservoir at Bridgewater was estimated at 70.5 cu.ft. per second. This occurred during the latter part of 1925, in which year there was on the watershed the least rainfall of history. As the other extreme, the maximum flood of record at Bridgewater was in July, 1916, with an estimated flow of 83,400 cu.ft. per second. In other words, a range of nearly 1,200 to 1.

Not only have these extremes been recorded, but the flow of the Catawba for considerable periods also has great variations. Hence, without the present co-ordinated storage facilities the stream would have comparatively little value as a source of dependable power. This was recognized from the conception of plans for complete utilization of the stream. As a result, with the developments thus far made, the stream has averaged an output of more than 1,400,000,000 kw.-hr. of electrical energy annually for several years. Thus a system of well-planned storage reser-



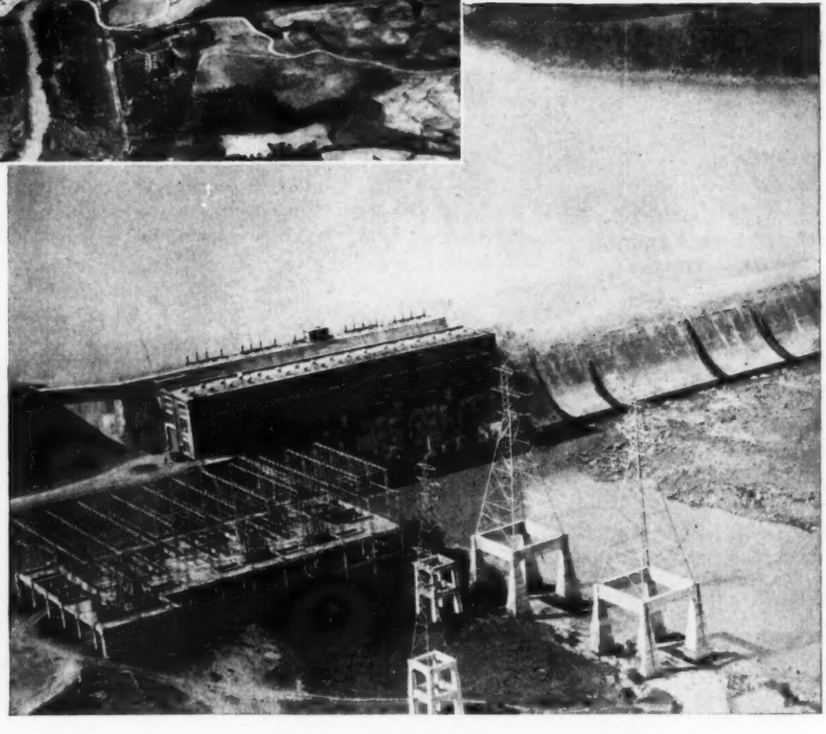
Relative positions and heads on Catawba River plants

voirs under a single management has rendered a comparatively minor stream a tremendous source of power.

There are many angles to the economies and increased efficiencies made possible by the handling of the river in the comprehensive way that its resources have been developed. Notable among these are two completely new plants that have been installed in connection with the eighth and ninth dams downstream. The original installation at both these dams has a rated capacity of 41,600 hp. With the conservation of the flow of the river above these dams by means of upstream reservoirs it has been possible to add 51,000 hp. at the eighth and 54,000 hp. at the ninth dam. At the same time the annual capacity of all the plants below any one new development has been increased importantly, although not always in exact proportion, by such additional storage capacity.

Five hydro stations on the lower reaches of Catawba River

Overflow dam without spillways at Wateree station



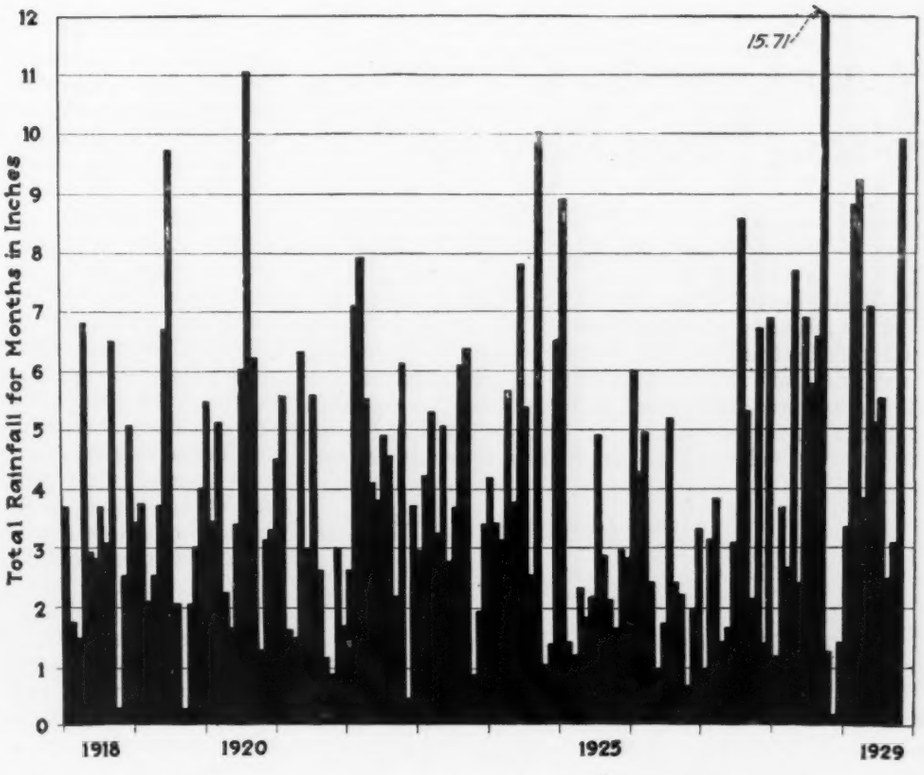
Operation of the system is confronted by two great variables which can never be resolved into constants. Hence, no approach to a formula for operation is possible. In fact, there rarely are single days in which any one set of conditions holds long enough to permit continuity of procedure at all points in the system.

One of the great variables presented is the fluctuation in the load on the system. The load fluctuation within itself has many factors which cause a variation in its hourly, daily, weekly, monthly and annual totals. Among these are seasonal changes, general business conditions, agricultural crop results, holidays and other social affairs, plus a variety of local factors not readily definable.

The other great variable is the run-off from the stream watershed. The conditions affecting this and the results experienced have already been discussed.

With a background of 25 years experience in serving the territory dependent on the system, it is possible fairly accurately to gage the load requirements. Effects from shutdowns of plants at meal hours, Saturday afternoons, Sundays and holidays are rather well determined. Results from seasonal and weather changes also can now be somewhat closely estimated. Even the increase or decrease arising from general shifts in business in the territory can be predicted fairly closely. Over all is the

Monthly rainfall at Wateree station



constant annual increase at a quite uniform rate of the total load on the system. And still, with all these, there remains always an indeterminable rise and fall in power demand for operating periods of various duration.

In the case of the watershed run-off variable, long experience has come to be invaluable in determining seasonal operating policies for the water-power plants. In general, water is conserved through the period from January 1 to the end of the summer rains to be drawn on in the normally dry fall season.

Even this normal average condition for any one year may change entirely, as in 1928 and 1929. There may be a series of unusually dry years, as in 1925, 1926 and 1927. Hence, no fixed policy is possible even on the seasonal variation.

When it comes to day-by-day and week-by-week policies for handling the river, they must be determined as the load and run-off conditions change. To check on the run-off possibilities very accurate rainfall and weather records are constantly maintained at all ten dams of the system. The operators at each plant report these records regularly by telephone to a central load dispatcher in the main office in Charlotte. If a storm occurs the local observer reports hourly the amount of rainfall, the stage of his reservoir and any other pertinent information for immediate use or future reference.

With the accumulated experience of the organization, the handling of the waterwheels of the several plants ordinarily becomes somewhat routine. The general scheme is to flatten out flood crests so that no water spills over any dam. If a local storm occurs midway on the system of such magnitude as to indicate a run-off in excess of the capacity of any set of wheels below that point, full load is at once shifted to that plant. At the same time, enough wheel gates are opened right on down-stream to take the expected flow in excess of the available unused or desired reserve storage capacity of the plants along the way.

So far as the auxiliary steam plants of the system are concerned, any one or more units in them, when once placed on the line, are kept running practically at their most efficient capacity. In other words, all variations in the load on the transmission system are absorbed by the waterwheel units when the steam plants are running.

The hydro-electric projects of the Duke Power Company were designed by the engineering department and either built by or under the supervision of the construction division of the company. W. S. Lee is chief engineer and vice-president of the Duke company.

Progress Due to Research

THE phenomenal increase in the use of electricity in steel mills during the past 25 years has no doubt been one of the greatest factors contributing to the wonderful progress made by the steel industry. This increase in the use of electricity is a direct result of the research policy established by manufacturers of electrical equipment. Twenty-five years ago there was in the minds of some a question as to the advisability of adopting a policy of purely research work, but today no industry can build for the future without establishing a definite research policy.

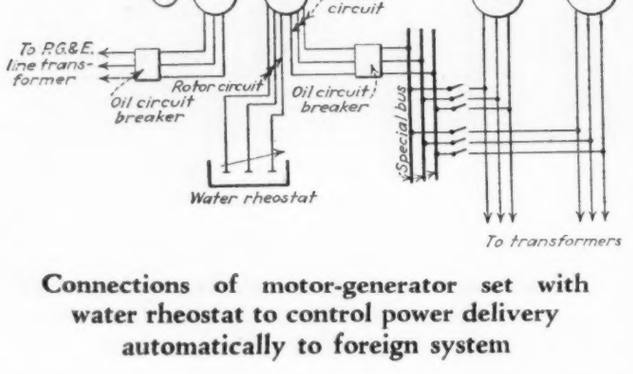
W. H. BURR
Chairman A. I. & S. E. E. Electrical Development Committee

Motor-Generator Obviates Splitting Power Plant Bus

By M. M. McINTIRE

Electrical Engineer Imperial Irrigation District, Imperial, Calif.

POWER from the Don Pedro plant, which was placed in operation by the Turlock and Modesto (California) Irrigation Districts in 1923, is delivered to four agencies for distribution. Each district has its own transmission line to its own distribution system. The Turlock district sells its surplus to the San Joaquin Light & Power Corporation, delivering the power over its own transmis-



Connections of motor-generator set with water rheostat to control power delivery automatically to foreign system

sion lines to Turlock and thence to the San Joaquin system. In addition to this a certain amount of power is delivered to the Pacific Gas & Electric Company at the power house in payment for water rights acquired at the time the dam was built.

Briefly, the plant consists of five generators totaling 35,000 kva., two high-tension buses, all switching being done on the 60-kv. side, and five outgoing lines.

It was of course impossible to deliver power to both these power companies from the same bus and it was seldom possible to apportion the machines to the two buses in such a fashion that full advantage could be taken of the water which was required to pass the dam for irrigation purposes. The contract with the Pacific Gas & Electric Company called for delivery of a certain amount of power each day, so that it was considered advisable by the district engineers to separate this load from the main system so the loads of the two districts and the San Joaquin company could be served from the same bus or the two buses in parallel. To accomplish this separation a 2,500-kva. motor-generator set was installed, thus mechanically coupling the power house bus with the Pacific Gas system. Since this is an unusual installation, engineers may be interested in a short description of the equipment.

The 6,900-volt generator and the wound-rotor induction motor driving it are mounted on a steel bedplate made up of H-beams on which are mounted two support bearings. The outboard bearing of the motor is mounted on a separate pedestal. Beyond the outboard bearing of the generator is mounted the exciter with its rotor on the end of the generator shaft, extended. The induction motor operates on 6,900 volts, taking its power from a special low-tension bus connected through disconnects to Nos. 4 and 5 generator leads. This machine is equipped with six slip rings, two per phase, which are connected to a water rheostat. The electrodes of the rheostat are motor operated and controlled by a contact-making wattmeter mounted on a special two-panel switchboard located near the set. Two 69-kv. oil circuit breakers were installed, one as a starter switch for the motor and the other as a synchronizing switch between the generator and the step-up transformer, which in turn was connected to the Pacific company's line by means of an air break disconnect switch. The accompanying diagram indicates the scheme of connections used.

In order to accomplish a transference of power from the 60-cycle power house bus to the 60-cycle Pacific line the motor of this set was designed with fourteen poles, while the generator has sixteen poles. Synchronous speed of the set is therefore 450 r.p.m., while the motor no load speed is 514.

The set operated very successfully, the only difficulty arising from the fact that in order to carry full load the salinity of the water rheostat solution had to be increased to the point that at no load the motor speed was too high to permit synchronizing. It was found that it was necessary to cut off the power to the motor after it was started and catch synchronous speed as the set slowed down. A little practice on the part of the operator and this was done without any shock to the system.

The equipment was furnished by the Westinghouse Electric & Manufacturing Company and installed by the writer under the supervision of R. W. Shoemaker, electrical superintendent of the Turlock Irrigation District, who conceived this plan to satisfy these peculiar operating difficulties.

Electricity in the Home

WHAT is true service to the home? We of the schools of home economics believe that the ultimate purpose of our efforts is that people may gain satisfaction from living. It is our business to educate toward an understanding of what this means and then to make every effort to open up possibilities whereby it may be brought about.

Here is where the electric utilities step in and assume a share of the responsibility. They want to furnish more and more power to more and more homes. We want more homes to use just as much more power as they can afford to use, and we want them to use it for a definite purpose —in order that the family may have more time, strength, health and nerve force for better things in life than household tasks.

FLORENCE D. SCHERTZ,

Professor of Household Science and Acting Dean School of Home Economics, Oklahoma A. & M. College

Increasing Intensity in Street Lighting

By R. J. DRAKE

Street Lighting Engineer
Public Service Company of Northern Illinois, Chicago, Ill.

IN EVERY PHASE of electricity utilization the ideas of today are hampered in, or even prevented from, execution by the inadequacy of yesterday's conceptions. This is as true in street lighting as in domestic service. The rapidly spreading use of high-illumination intensities in street lighting has forced into acceptance as usual design a device that at first was intended to be only a special equipment for occasional and extraordinary application. This is the transformer through which high-current lamps are connected to low-current series circuits.

THUS, many existing high-intensity installations embrace a pure expedient in their fundamental design. The recent development of non-metallic sheath cable permits a sufficiently high current in circuit conductors so that 20-amp. lamps can be fed directly. In this article is shown how the elimination of the lamp transformer results in major savings in street-lighting costs for installation and operation.

SAVINGS in the order of 60 to 70 per cent in labor and material and 50 to 60 per cent in annual cost apparently result from comparison of affected items in 6.6-amp. and 20-amp. street-lighting circuits for the same service. The figures set up in this article refer to the specific case of a 50-kw. circuit containing 90 10,000-lumen lamps and 10,000 ft. of single-conductor cable. Such a circuit may be taken as typical of present-day high-intensity illumination in business streets.

Street lighting as an electric utility service is being pushed more vigorously by some central stations than by others. Municipal governments, civic improvement organizations and business men are rapidly becoming converted to the values and advantages of high-intensity street lighting. Thus even the utilities which do not put large effort into the development of this class of business are finding the demand growing of itself. They are finding that widely spaced lamps of 100 to 400 cp., as were installed a few years ago, do not meet the present demand. Considering these factors and also that in some states individual property owners are permitted to replace low-intensity lamps in front of any given lot or building with one of higher intensity by agreeing to pay for the additional energy consumed, it is apparent that many utilities have been and will be confronted with the necessity of adding load to existing circuits or of installing new ones. For this reason it is opportune now to consider what advantages may be gained from going to the higher current capacity circuits.

20-amp. system has advantages

To operate 20-amp. series circuits efficiently the conductor must not be surrounded by a magnetic sheath or pipe unless both the outgoing and returning conductors are contained in the same inclosure, in which case the magnetic effect is practically neutralized. However, street-lighting circuits can seldom be returned in the same duct economically, for one of the principal advantages in the use of series circuits is that they can be looped over extensive territory so as to avoid long idle returns.

Briefly, 20-amp. series circuits have the following important advantages:

1. The conductor is economically loaded to approximately its capacity.
2. The use of auto-transformers and safety coils is unnecessary.
3. The circuit voltage is reduced to approximately one-third that of the 6.6-amp. series circuit for a given load.
4. Cost of underground cables is substantially reduced.
5. The number of lamps per circuit for a given voltage may be increased threefold.
6. The installation and maintenance operations are simplified.
7. Flexibility of operation.

It has been the general practice of utility companies to require municipalities availing themselves of flat rate street-lighting service to use 6.6-amp. circuits, which in general require the use of steel-taped cable or lead-incased cable in fiber ducts. This practice presents the following objections and penalties for concentrated high-intensity street-lighting service:

1. High voltages require expensive cables and very careful workmanship.
2. Difficulties in locating faults.
3. Excessive outages and corresponding penalties.
4. Excessive losses through the use of individual lamp transformers.
5. Excessive cost of purchase and installation of individual lamp transformers.

System accommodates trend of higher intensities

In the comparisons shown in this article only those items are tabulated which are affected by the difference between ampere capacity. The large percentage saving shown in Table I will not, of course, remain when all items of purchase and installation cost are included in the comparison. However, the saving will persist in a proportion that should not be neglected. The same kind of modification must be applied to the percentage saving in annual costs shown in Table II, but here also the saving remains an important item. The percentage saving of 34 per cent shown in Table III is an actual statement of saving, since it is concerned only with energy losses.

Any saving in installation and maintenance costs has a direct effect in hastening the promotion of high-intensity street lighting, but the thing of greatest importance is flexibility in a system. At the present time standards in street-lighting intensities are changing so rapidly that it is a common occurrence before the system is completely paid for for a merchant on a given street to petition the city government for higher intensity lamps than the installed capacity will allow. It is a well-known fact that once a building is wired it demands a mighty good salesman to sell the owner on higher intensity lighting and at the same time sell him on the idea of spending several hundred dollars to rewire his building to take care of the increased load.

The same thing is true of street lighting. When a system is installed it should be flexible enough to take care of present needs and also to permit increase of intensity at any place on the circuit without requiring additional equipment expenditure. This reason, if nothing more, warrants the progressive engineer in giving serious consideration to the 20-amp. system.

TABLE I—ESTIMATED COMPARISON OF LABOR AND MATERIAL COSTS OF AFFECTED ITEMS

6.6-Amp. Secondary		20-Amp. Secondary	
50-kw. regulator—(6.6-amp. secondary net)	$820.00	50-kw. regulator—(20-amp. secondary net)	$820.00
Cable—10,000 ft.—7,500-volt, steel-taped No. 8 parkway cable at $180 per thousand net	1,800.00	Cable—10,000 ft.—2,500-volt non-inductive No. 8 fiber tape at $110 per thousand, net	1,100.00
Labor—Additional labor to install 90 safety coils, $5 each	450.00		
Safety coils (90)—6.6 to 20 amp., 10,000-15,000 lumen at $32.75 each	2,947.50		
Concrete transformer vaults (90) $10 each	900.00		
	$6,917.50		$1,920.00
Saving	4,897.50		
Per cent saving	71		

TABLE II—ESTIMATED YEARLY COST COMPARISON OF AFFECTED ITEMS

Based on Certain Definite Assumptions

6.6-Amp. Secondary		20-Amp. Secondary	
50-kw. regulator—(6.6-amp. secondary)—$820 net, annual fixed charges	$117.50	50-kw. regulator—(20-amp. secondary)—$820 net, annual charges	$117.50
Cable—10,000 ft.—7,500-volt, at $180 per thousand ft. net, annual fixed charges	214.00	Cable—10,000 ft.—2,500-volt at $110 per thousand ft. net, annual charges	131.00
Cable losses—42 watts per thousand ft.—420 watts x 4,000 hr./yr. at 3 cents per kw.-hr.	50.40	*Cable losses—282 watts per thousand ft.—2,820 watts x 4,000 hr./yr. at 3 cents per kw.-hr.	338.40
Losses in safety coils—41 watts each x 4,000 hr./yr. at 3 cents per kw.-hr.	442.80		
Safety coils (90)—6.6 to 20 amp., 15,000 lumen at $32.75 each net, annual fixed charges	351.00		$586.90
Safety coil vaults—at $10 each net, annual fixed charges	106.30	Difference in annual charges in favor of 20-amp. secondary system	748.80
Labor—to install safety coils $5 each net, annual fixed charges	53.70	Per cent difference in annual cost	56
	$1,335.70		

No allowance is made for the slightly higher efficiency of the 20-amp. regulator nor the improved power factor of the system.
*Losses obtained from manufacturers.

TABLE III—ESTIMATED ANNUAL LOSSES IN CABLE AND SAFETY COILS

6.6-Amp. Secondary		20-Amp. Secondary	
Cable losses—42 watts per thousand ft. (10,000 ft.)—420 watts x 4,000 hr./yr. at 3 cents per kw.-hr.	$50.40	Cable losses—282 watts per thousand ft. (10,000 ft.)—2,800 watts x 4,000 hr./yr. at 3 cents per kw.-hr.	$338.40
Losses in safety coils—41 watts x 4,000 hr. yr. at 3 cents per kw.-hr.	478.80		
	$529.20		$338.40
Annual saving	190.80		
Annual saving—per cent	34		

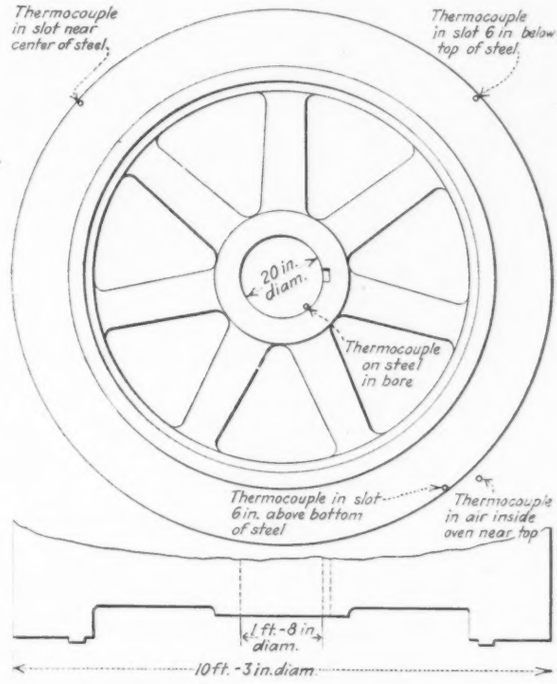
No allowance in made for the higher efficiency of the 20-amp. regulator nor for the improved power factor of the system.

Electric Heaters Used in Shrink-fit Shaft Assembly

By M. M. McINTIRE

Electrical Engineer Imperial Irrigation District, Imperial, Calif.

DURING the installation of machinery at the Exchequer power house of the Merced irrigation district in California it became necessary to assemble the 55-ton generator rotor on its shaft. No provision had been made in the original plans for this assembly, since it was expected that the rotating element of the generator would be shipped complete, less the field coils. Faced with the necessity of performing this operation in the field the engineers of the district and the Westinghouse


Thermocouple in slot near center of steel
Thermocouple in slot 6 in. below top of steel
20 in. diam.
Thermocouple on steel in bore
Thermocouple in slot 6 in. above bottom of steel
Thermocouple in air inside oven near top
1 ft.-8 in. diam.
10 ft.-3 in. diam.

Location of thermocouples while heating 55-ton rotor for shrink-fit shaft assembly

company found little data available to guide them in the selection of a method.

Several plans were discussed. The hysteresis method was rejected because of the danger of distortion stresses in the spokes of the rotor and the method employing submersion in boiling water gave insufficient expansion, together with danger of corrosion. The use of a hot oil bath was considered and abandoned as involving too great a fire hazard. The method finally adopted proved highly satisfactory and may prove of value to other engineers.

The rotor in question was for a 15,000-kva. vertical shaft, waterwheel generator and had a diameter, with pole pieces removed, of 10 ft. 3 in. Its shape and principal dimensions are shown in the accompanying diagram. The shaft was provided with a 3-in. hole for its full length as it was contemplated in future overhauling to be able to remove the turbine runner without disassembling the generator. The hollow shaft permitted the passing of a line through it from the crane to the draft tube.

To permit shaft assembly without use of a hydraulic press, the rotor was placed upside down on blocking on a heavy timber floor laid over the generator pit. A 2-ft. square opening was left in the floor directly below the bore of the rotor and the opening was temporarily closed by 1-in. boards tacked on the under side. The rotor was inverted in order that the shaft could be dropped into it.

A double-wall, asbestos-lined, wooden oven was then installed over the rotor. The two walls were separated by a 4-in. air space and a trapdoor 2 ft. square was installed directly over the bore of the rotor. About 6-in. clearance was left between the inside of the oven and the steel. Four 5-kw. industrial type heaters were then placed on the floor under the rotor and thermocouples installed as indicated. A heat run of 64½ hours, during which the rotor was brought to a temperature of 299.5 deg. F., was sufficient to increase the bore diameter from 20 + 0.000 in. to 20 + 0.033 in. The diameter of the shaft at ambient temperature was 20 + 0.009 in., but to increase the clearance further, cold water was run through the hollow shaft. This reduced the diameter to 20 + 0.007 in., providing a total clearance between bore and shaft of 0.013 in. on the radius. The shaft was suspended by the crane and dropped through the bore with no difficulty. The whole mass was then allowed to cool for 24 hours before handling.

It is felt that the care taken in obtaining a clearance of this magnitude was amply justified by the ease with which the shaft was dropped in. The only difficulty attendant to the whole process was that of maintaining the air temperature at a constant value and the vigilance required to guard against fire. One man per shift was all that was required during the heat run and the regular rigger crew handled the shaft during the final operation. An accurate record was kept of the temperature as indicated by the thermocouples and twice a day the trapdoor was removed from above the rotor and the diameter of the bore determined by an "inside" micrometer.

▼ ▼ ▼

Electricity vs. Steam for Oil Well Drilling

From a recent report of the Commercial Section, Southwestern Division, N.E.L.A.

Well	Delamo No. 2	Delamo No. 3
Power	Steam	Electric
Depth, feet	3,530	3,516
Formation	Sand and shale	Average hardness
Casing	882 ft. 12¾ in.	758 ft. 15¼ in.
	2,947 ft. 10 in.	3,014 ft. 10 in.
	3,530 ft. 8¼ in.	3,516 ft. 8¼ in.
Total horsepower installed	280-Boilers	200-Motors
First cost of power equipment	$9,441.76	$4,932.91
Transportation and installation cost	1,158.30	1,214.94
Total cost installed	10,600.06	6,147.85
Kilowatt-hours used	.....	94,344
Cost at $0.0188 per kilowatt-hour	.....	$1,773.00
Gas fuel used, cu.ft.	94,373	.....
Cost at 25 cents per thousand	$2,359.37	.....
Maintenance	85.00	88.50
Repairs and depreciation	1,270.25	280.90
Cost of disconnection at completion of well	129.15	27.62
Fixed charges	331.94	170.09
Interest, 6 per cent		
Taxes, 1 per cent		
Engineering, ½ per cent		
Total operating costs	$5,320.00	$3,595.05
Cost per foot of hole drilled	1.50	1.02

To Serve a Railroad and

"THIS is one of the most intricate and difficult pieces of work that has ever been undertaken in this city and certainly by this railroad."—

F. B. FREEMAN,
Chief Engineer New York Central Railroad

SUPPLYING electrical energy for railroad operation and lighting and power for a group of surrounding structures, including the Grand Central Terminal, hotels, skyscraper office buildings, apartments and an exhibition hall, are but a few of the duties of the lighting and traction substation recently placed in operation far under the sidewalks of New York. Service continuity is paramount here.

WHOLLY unprecedented difficulities were overcome in moving from the old location to the new without interruption to supply or impairment of reserve capacity continually available.

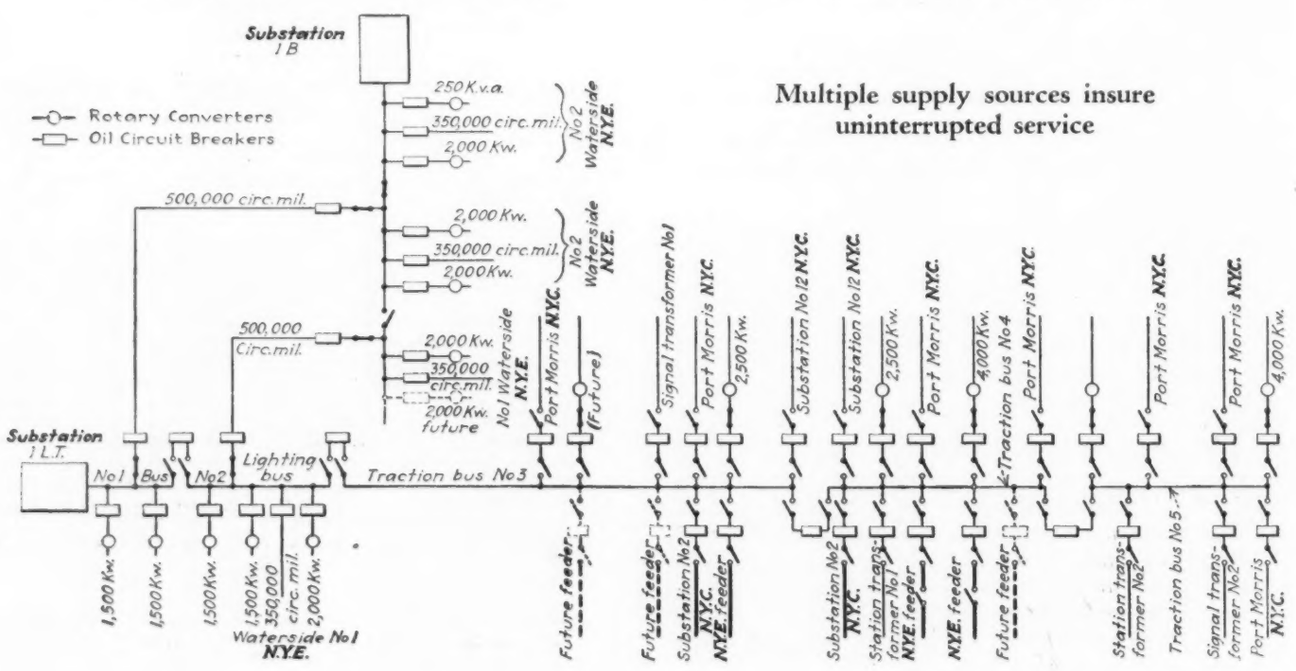
By C. B. MARTIN

Transmission Engineer
New York Central Railroad Company

OPERATION of the passenger trains of the New York Central and the New York, New Haven & Hartford railroads in and out of the electrified Grand Central Terminal, New York City, requires about 15,000 kw. of 666-volt direct current capacity. In addition there must be battery-charging service for the railroad cars and station trucks, energy for elevators, compressed air for miscellaneous services, including elevator door operation, fire pump service and hot and cold water supply. The Grand Central Terminal includes the railroad station, six hotels, ten skyscraper-office buildings, six exclusive apartment houses and other structures. These require about 16,000 kw. of direct-current energy for lighting and incidental power. All the electrical, steam and other power services used are supplied by the railroad company. Formerly the necessary facilities were divided variously throughout the terminal zone, but the contemplated erection of the new Waldorf-Astoria Hotel on the site of the 50th Street power house and substations of the New York Central necessitated a rearrangement of power supply and distribution.

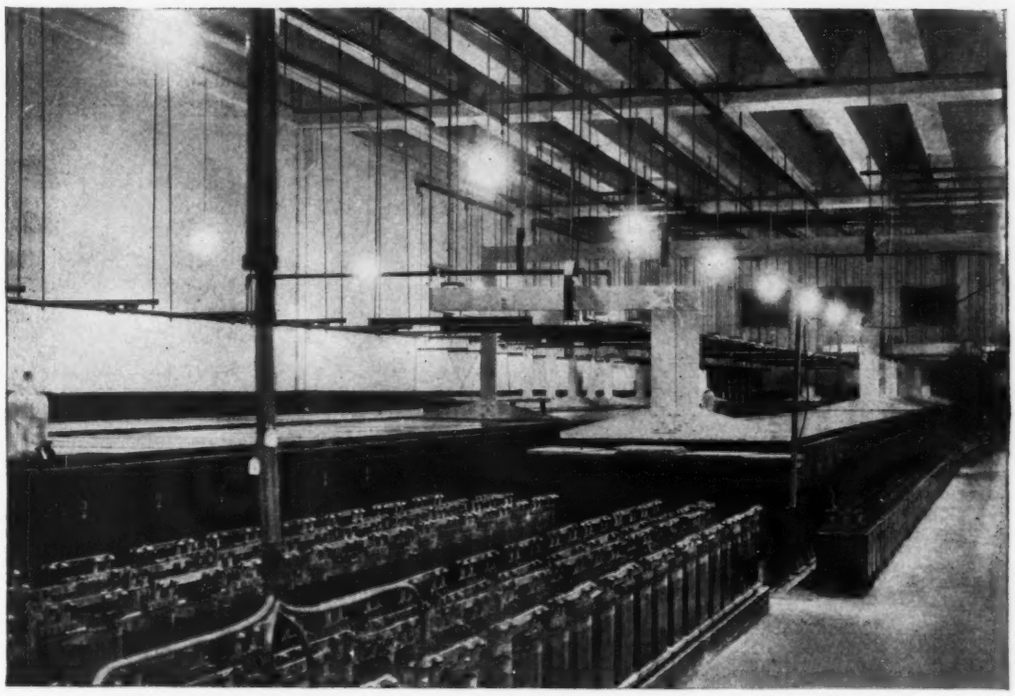
The problem presented to the electrical department was that of removing that part of the terminal light, heat and power facilities installed on the 50th Street block and providing elsewhere,* by various means, equiv-

*ELECTRICAL WORLD, *February 22, 1930, page 377.*



Multiple supply sources insure uninterrupted service

a City Within a City



Courtesy Thompson-Starrett Company

A 25-minute direct-current reserve for a 49,000-amp. load

alent sources of supply. To make this transfer without interruption of service and in the time agreed upon by our executives was truly a great problem. At a cost of $175,000, a large basement had been provided under the Graybar Building at the time of its erection.

Complete service plan established

It was decided to: (a) abolish the old steam-generating plant at 50th Street and take all steam from the New York Steam Company, which had extended a 24-in. main to the corner of 43d Street and Lexington Avenue and other mains to 49th Street and Lexington Avenue in the anticipation of such a move; (b) remove the two boilers installed in the 43d Street underground plant, which were used only in the heating season, and adapt the space for the accommodation of the lighting and traction substations, standby battery and switchboards; (c) locate the hot water heating plant, air compressors, fire pumps, hot and cold water pumps and other auxiliary apparatus which could be accommodated under the Graybar Building in the space reserved for their ultimate placement at the time of erecting the building; (d) make use of existing masonry conduits as far as possible to contain the electric cables and to supplement these by an overhead metal conduit system to be installed in the trucking subways of the terminal; (e) order sufficient new apparatus to establish service in the new substation so that one by one in rapid succession the seven rotaries and their transformers could be released and moved to their new locations; (f) utilize the piping system of the terminal, which was laid out in a square with one corner near 50th Street, where steam, water and air were introduced, and another near 43d Street. These pipes were opened at 43d Street as a new feeding point and closed at 50th Street, thus using the same pipe; (g) make the 36 third-rail feeders, which extended through a complicated system of ducts from the substation at 50th Street to various third-rail sections on both levels of the terminal, operative from a circuit breaker house to be constructed at 49th Street. To lead them all to the 43d Street substation would have required an expensive duct system and miles of cable.

The feeders were to be connected to switchboard panels in the breaker house, but under remote control from 43d Street. Twelve large cables were connected between the substation at 43d Street and the circuit breaker house at 49th Street. In operation these cables carry the average current to the circuit breaker house, where it is subdivided among the various third-rail feeders. The electrical effect is the same as though the substation had not been moved.

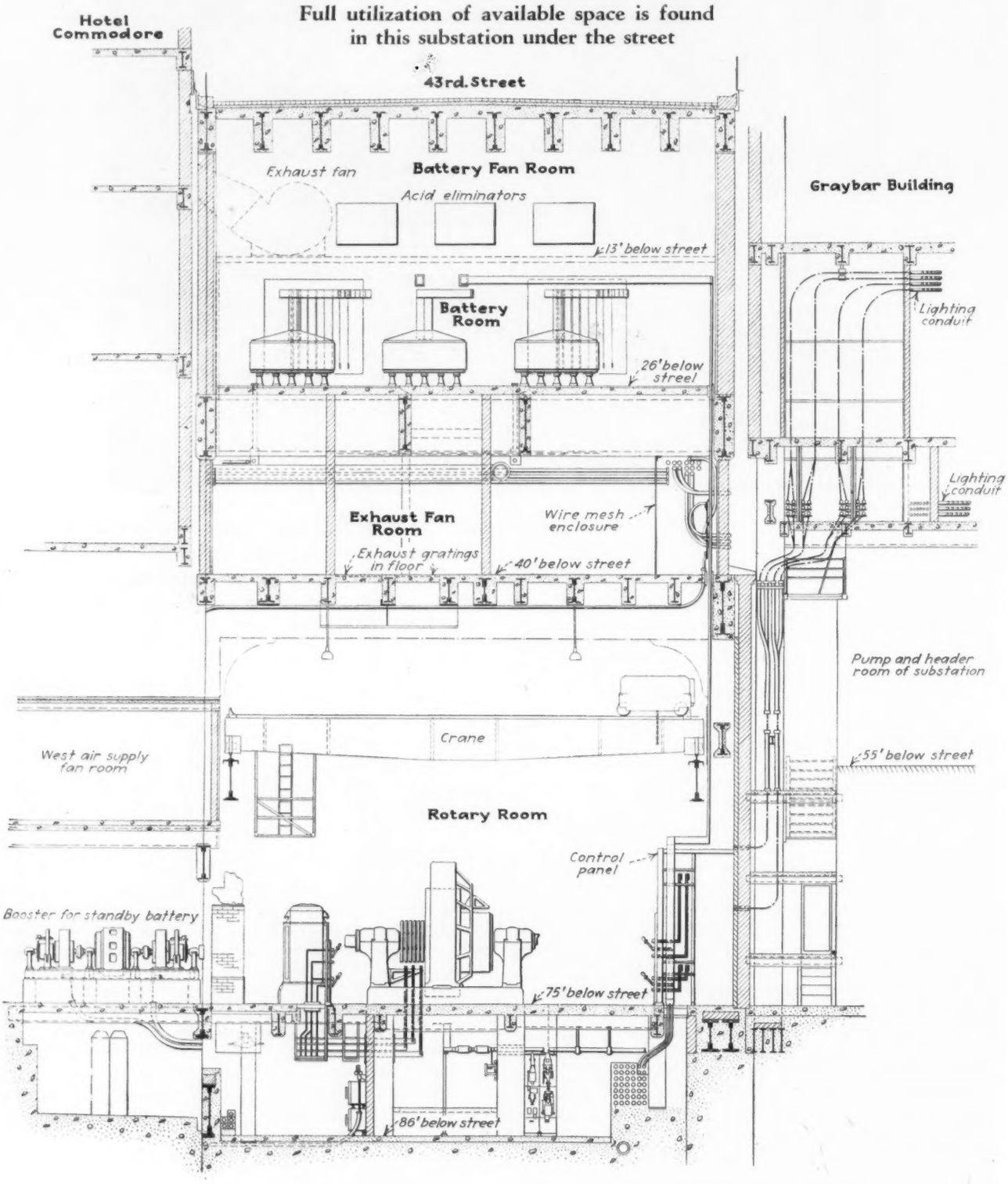
The 43rd Street boiler plant was unique in its location. An excavation about 90 ft. deep and 225 ft. long by 60 ft. wide had been made in the solid rock between the Commodore Hotel and the Graybar Building and in this space a boiler plant building had been constructed, containing two boilers, with room for four more. The roof of this plant was a private street, an extension of 43rd

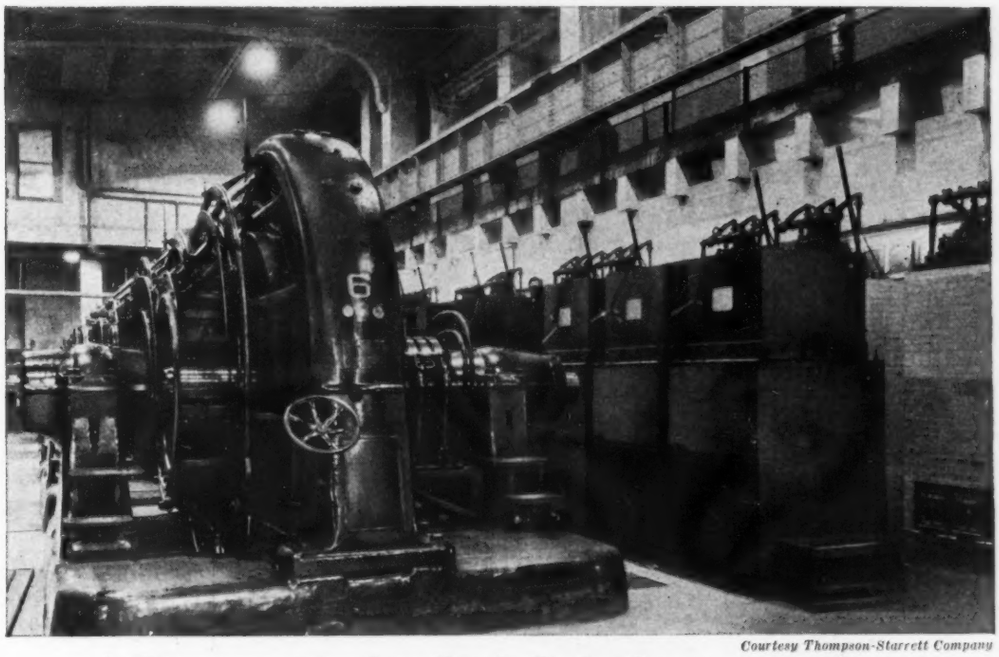
Street. The plant consisted of four floors, a basement for the handling of ashes, a boiler room, a meter room and the coal bunkers. The stack extended to the top of the Commodore Hotel and was concealed in that structure.

To convert this building into a substation, it was necessary to remove the boilers, enlarge the basement, construct concrete foundations for the rotaries, provide an operating floor filled with conduits and with spaces for transformers, switchboards, oil switches and other apparatus. Also, crane girders and a 30-ton electric crane were installed.

The meter room became an exhaust fan room, taking the air from the top of the substation and exhausting it into the boiler breeching and thence up the stack. The bunker space was converted into a standby battery room,

Full utilization of available space is found in this substation under the street





Courtesy Thompson-Starrett Company

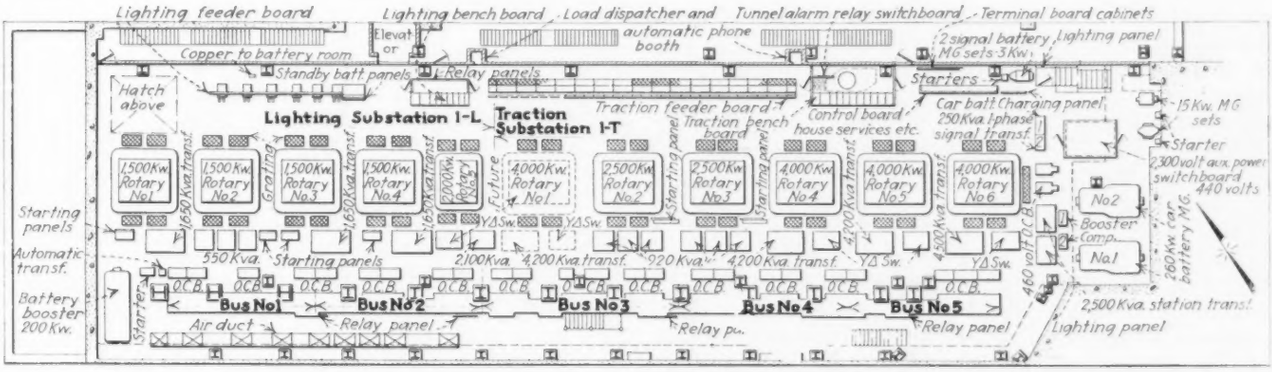
Rotary converters for railroad-office-hotel-apartment supply in subterranean substation

thought to be the finest in the country. Thus, the boiler plant, consisting of only two boilers, and those operated only in winter, was replaced by one of the largest substations in the world. Substantially every cubic foot from the basement to the street level was utilized for electrical purposes.

Continuity of the lighting service in the terminal is insured by two standby batteries. Together they will maintain the lights at full candlepower for 25 minutes. The standby battery at 50th Street consisted of 150 cells, each weighing 4,500 lb. There were two major problems in connection with moving this battery—first, to move it without injury and, second, to insure full reliability of service without it in operation. It is usual when moving such a battery to remove the acid and the plates and reassemble them at the new site. In this instance a different plan was decided upon. Part of the acid was removed, the plates clamped in place, wheels were placed under the tanks and they were hauled from 50th Street to 43d Street underground by electric truck, making use of the long mail-handling platform along a side of the lower train level. In addition to being hauled, each cell had to be lowered by tackle a distance of 55 ft. at 50th Street and raised by an elevator at 43d Street. Use had to be made of the railroad's underground passage, since a city ordinance prohibits the hauling of acid in open tanks through the streets. The battery was moved without spilling a drop of acid, without injury to any cell, and when reconnected, was placed in service as soon as charged.

Reliability of service was insured during the transfer by connecting the lighting substation at 50th Street to the New York Central high-tension system and the lighting substation under the Graybar Building to the New York Edison system. Either station, in combination with the remaining standby battery, would have maintained the lights for approximately 25 minutes, should the high-tension power of either system have failed.

As far as practicable, all material was moved by lowering it onto flat cars at 50th Street and unloading on the



Ten rotary converters totaling 25,000 kw. with transformers, breakers, protection, control and distribution feeders and panels in floor area of 225x60 ft.

Courtesy Thompson-Starrett Company

Space limitations necessitated high switchboard for SA-2 breakers

platforms at 43d Street, where it was lowered to its proper level. New equipment was delivered similarly. The unloading of these cars had to be done from operating tracks which could be kept out of service but a few hours at a time. To remove 30-ton armatures in a limited number of minutes required exceptional skill.

The finished substation represents one of the most compactly designed and unusual structures of its kind in the world. The cooling air is taken through louvers located 50 ft. above the street level down a vertical shaft to 90 ft. underground and is filtered on its way to the air chamber below the rotary converter room. Approximately 350,000 cu.ft. per minute is allowed as the ventilating system capacity.

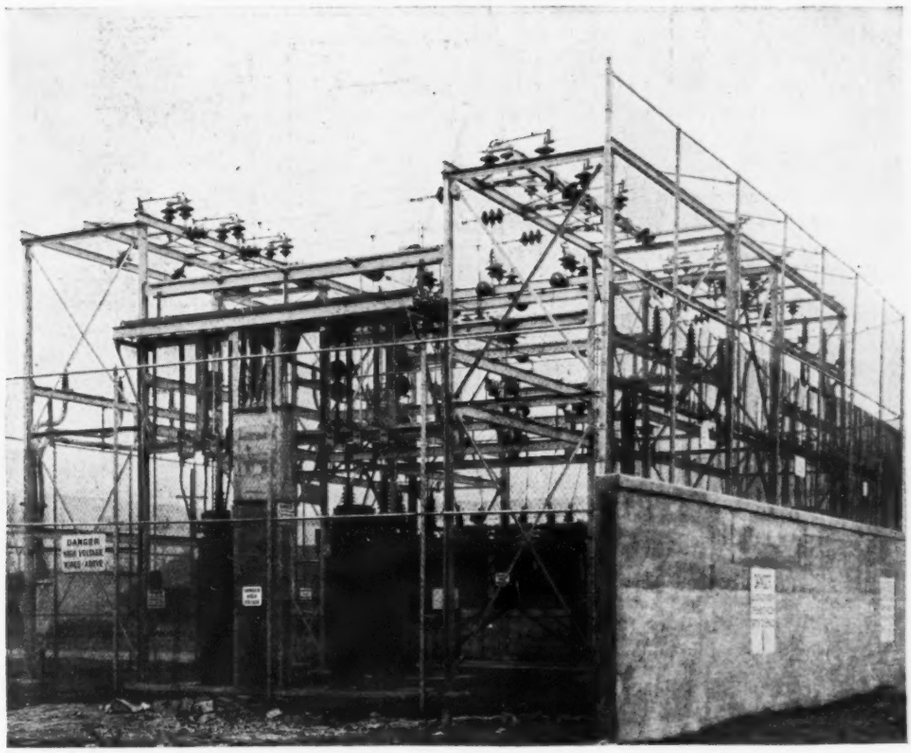
The ten rotary converters, totaling 25,000 kw. in capacity, with space for an additional 4,000-kw. unit, have been aranged as shown in an accompanying figure, to minimize space requirements and yet provide adequate facilities for all operating and possible fault conditions. Above the rotary room are the exhaust fans, which take the warm air from the substation and pass it into the stack formerly used to carry the gases from the steam plant. The air from another lighting substation, located very close to the new one, is exhausted into the new substation near its ceiling and thence by the same fan system up the stack. Cooling air is also taken from the Grand Central Terminal track area through a 10x10-ft. rock tunnel. Above the fan room, and resting upon the extremely sturdy construction of the old coalbin girders, is the storage battery room.

As shown in the layout illustrating the power supply for these two substations, service may be obtained not only from the New York Central Railroad generating system, but from the New York Edison Company and the Interborough Rapid Transit Company. The New York Central and Edison systems do not operate in synchronism, so that in order to offer flexibility in the selective application of power from either source to the desired equipment the buses are sectionalized in five parts to permit ready and safe changeovers. Inside each lighting and traction feeder three insulated wires are stranded in with the copper of the cable. When these become alive through a cable breakdown they open the breakers at each end of the cable. Because of the high amperage carried on the various feeders the load currents are often as high as their fault current would be, and it is necessary to make some provision in order to avoid the destruction of cables through a flaming arc under fault conditions.

Close co-operation in the work was secured by weekly conferences between the engineers of the railroad and the General Electric Company and the executives of the Thompson-Starrett Company, the contractor. Under these conditions the work progressed steadily and rapidly to the accomplishment of every objective.

Editor of "Successful Farming" Says:

THE American farmer is hard-headed. He has had some awful wallops that have developed that hard-headedness. He has been soaked at times by various manufacturers of farm equipment and he has been sold every "doodingus" from a scythe to a threshing machine. Therefore he is going to hold your utility salesman mighty close for a demonstration if you are to get through on that job. And there, I believe, is the tremendous responsibility of the utility company, to scrutinize every piece of equipment that goes into the farmer's field, to see that that equipment really serves the farmer's purpose.



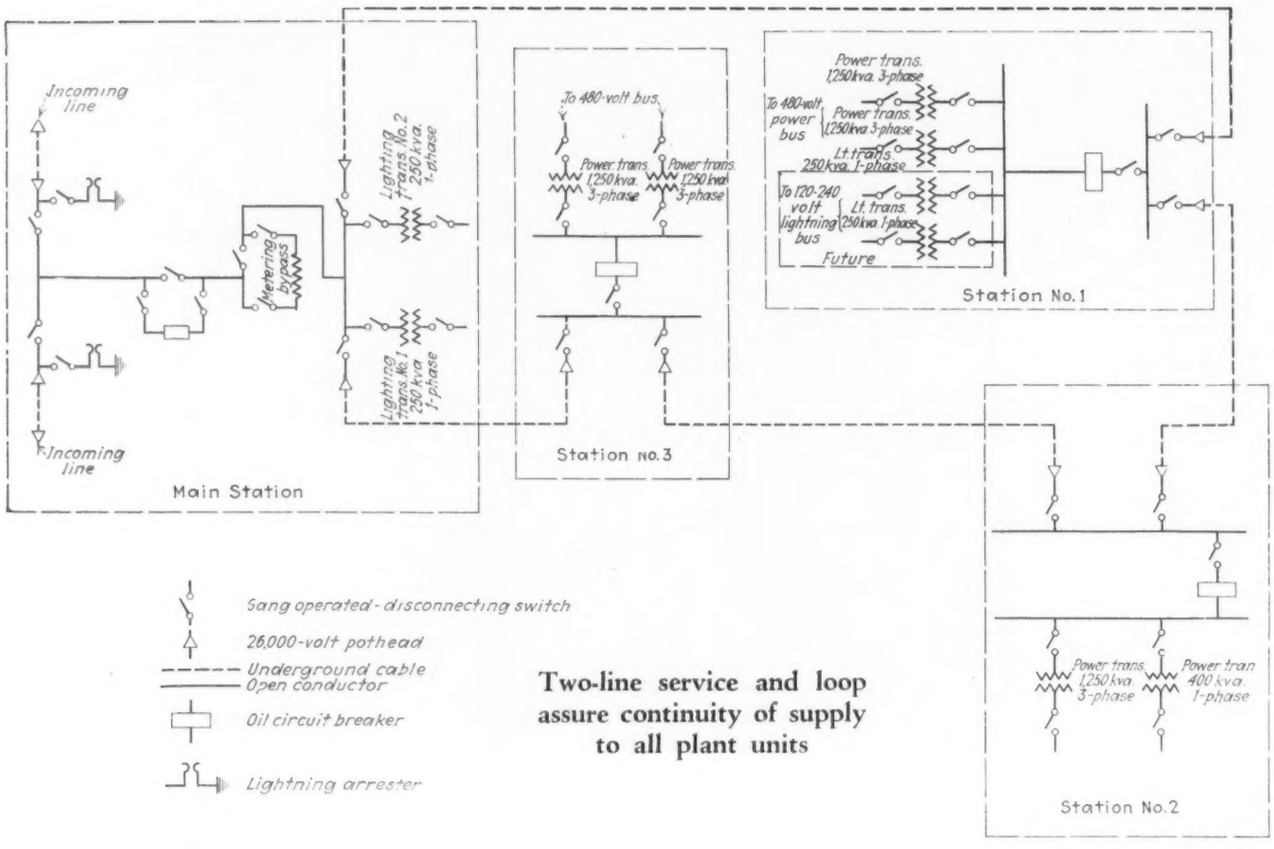
Substation is energy receiving point of Nash Motors Company Racine plant

Automobile Plant Adopts 26 Kv. for Economy

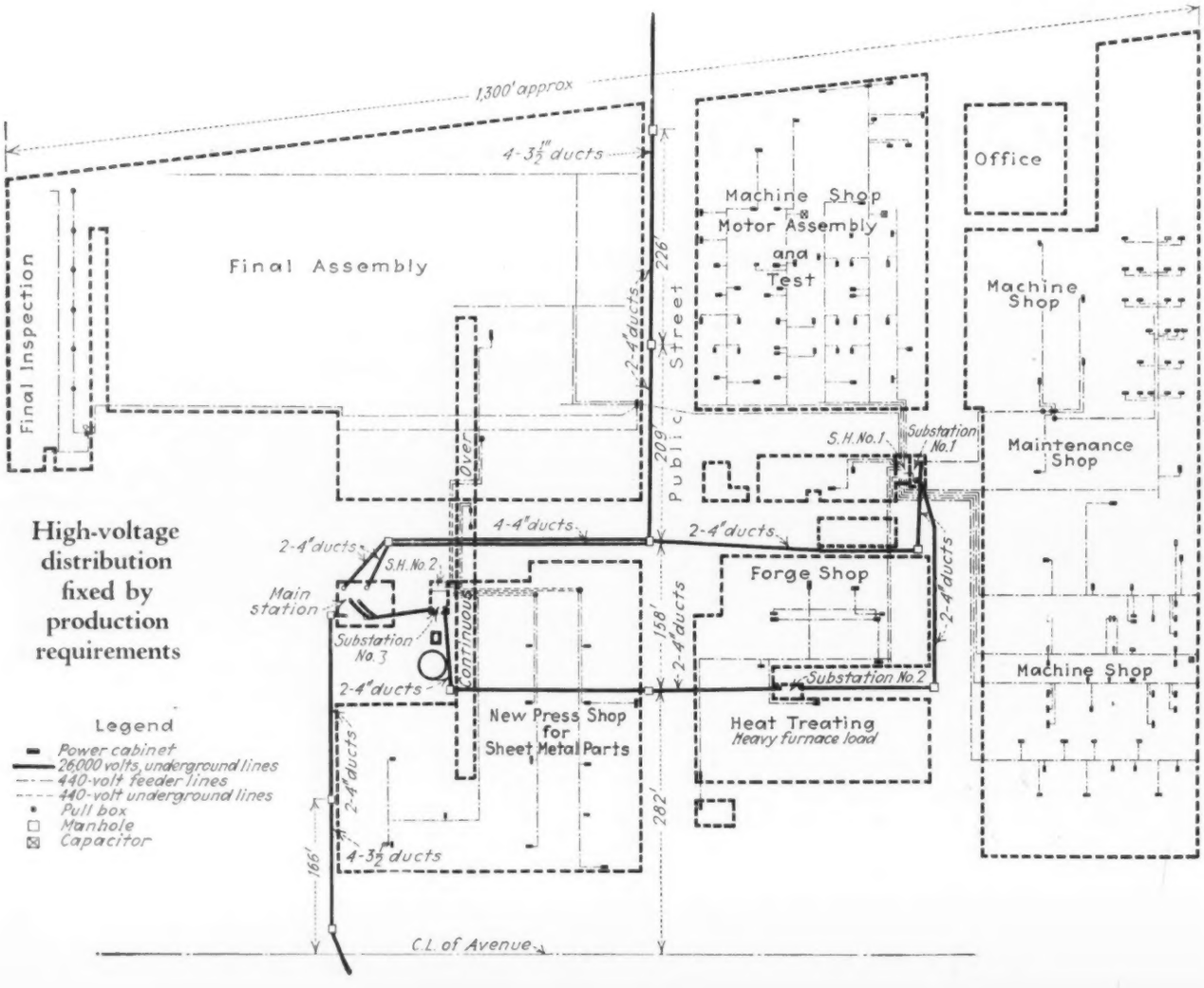
High-tension underground loop and logically placed distribution substations assure reliability and economy in electricity supply to motor car manufacturing plant

CLOSE co-operation between purchasers of electric power and the supply utility has resulted in greater safety of operation and increased economy of distribution in an installation of 26-kv. underground cable and distributing substations in the Racine plant of the Nash Motors Company. This particular plant, like many others in the automobile industry, has gone through comparatively long periods of physical growth and expansion of production methods, until finally the addition of a new manufacturing unit made imperative a drastic revision of the manner of energy supply and distribution within the plant area. The new unit added to the Racine plant was for the production of pressed steel parts such as fenders, hoods, side aprons and the like. Large amounts of power were required for the operation of presses and the continuous type japanning oven that was installed at the same time. Service to the new unit demanded a considerable addition to the electrical load and the installation of electrical supply equipment. The occasion appeared opportune for the complete rehabilitation of electricity supply to all departments of the plant. This was done by the installation of a 26,400-volt underground loop and of three distributing substations.

The existing electrical installation was attended by large distribution losses and poor voltage regulation on the working circuits due to haphazard growth of the system. The new installation promised to supply adequate service throughout the entire plant area and, being underground, to remove entirely the danger to life and property inherent in high-voltage overhead construction in large plant areas.



Two-line service and loop assure continuity of supply to all plant units



High-voltage distribution fixed by production requirements

The new installation is served from a main station located as near as possible to the center of the ground plat. This is not the center of the existing plant, as is apparent from the drawing, but plant extensions must necessarily be to the west, and it is expected that the main station will find itself at the center of the load in a comparatively few years. Service is brought to this point by two underground cables, one rising at the north side of the Nash property and the other at the south side of the property. From these points the lines continue overhead to a substation of the Milwaukee Electric Railway & Light Company by two distinct routes. To provide service in the event of trouble at this substation these lines are also tied into another substation. Normally only one line is in use, the other being held for stand by. From the main station the underground loop starts out and reaches first substation No. 3. This substation contains two 1,250-kva. transformers which serve the power load in the adjacent sheet metal press shop and final assembly building. Energy from this substation is used also in the continuous conveyor type enameling oven which connects the two buildings. The underground loop then continues on to substation No. 2. The greater part of 1,650 kva. capacity in this substation is utilized in the electric furnace load of the heat-treating shop. The forge shop, being equipped with steam hammers, has a comparatively small electrical demand. Substation No. 1, from which the loop goes back to the main switching station, contains two 1,250-kva. transformers and has space for two 250-kva., single-phase transformers for lighting, which will be installed later.

It is interesting to note the three-party combination by which this installation was engineered and installed. The basic suggestion for the design and detailed drawings for the installation of the apparatus came from the Delta-Star Electric Company, which furnished a large part of the equipment; that is, steelwork, bus supports, gang-operated disconnecting switches and other special devices. The oil breakers are General Electric. The utility company designed and installed the entire underground system. The secondary distribution construction inside the substation was done by the motor company and the high-tension work by the utility. Having installed or supervised the installation of all equipment on the high-tension side, the utility company is assured that the work is up to its standard and it can serve the motor company without any misgivings as to the quality of work done on the customer's premises. The utility company maintains the cable and transformer equipment for the Nash Motors Company and has free access to the substations at all times. High-tension switching is done either by a utility employee or with a utility man in attendance. If it should happen that switching must be done quickly in an emergency the customer's electrician will perform the operation, but only on order from the utility load dispatcher.

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Stockroom Brought to the Loading Platform

MINIATURE portable stockrooms have recently been put in use by a number of service companies which send out trucks loaded with repair, replacement and new parts. Instead of requiring installers and repair men to wait in line while the stock man fills the requisitions, they actually "bring the mountain to Mohammed."

One Western telephone company operates this system as follows: The portable racks are designed with ample capacity for all the various items required by the installation division. The stock men fill these portable racks with a certain predetermined number of pieces of each item and deliver them to the loading platform at 4:15 each afternoon. From that time until 5 o'clock requisitions are filled from the portable racks, placed in the installers' automobiles for use the following day, then promptly and early the following morning the men are ready to go out on the job. In the three racks pictured approximately 1,000 different items are available.

The trucks used for transporting these racks are standard trucks, 74 in. long and 38 in. wide on the platform. On these trucks are placed two standard Lyon shelving units, double faced, 36 in. wide and 36 in. deep. One of the racks is fitted with 108 adjustable compartment boxes which permit the convenient storage of a great many and a wide variety of small items.

Perambulating stockroom saves time

Supplies and materials are requisitioned by service men right on the loading platform

READERS' FORUM

Columbia Fault Relaying Differs from Detroit Scheme

To the Editor of the ELECTRICAL WORLD:

Messrs. Dean and Wetmore's article in the May 24, 1930, issue of the ELECTRICAL WORLD, in which the ground fault relaying at the Waterman station was described, suggests some comparisons with the ground fault protection of the 1925 Columbia power station installation. The 13.2-kv. bus at the Columbia station consists of two sections with complete dual switching on each section. Each section is supplied from one 63,000-kw. generator. Four circuits leave the bus.

The fault bus on each section consists of a main and reserve installation. Thus, for example, a fault on the main bus will cause the opening of all the oil circuit breakers connected to that part of the bus; the service, however, will not be interrupted, as the reserve bus will still be in operation. In addition to the relays on the main and reserve portions of the bus, a totalizing current transformer is inserted in the fault bus between the point where the main and reserve fault buses tie together and the connection between the station grounding system and the fault bus. This current transformer is connected to a relay which opens all the oil circuit breakers connected to both the main and reserve buses in its section. This relay is of the induction type and has a longer time delay than have the relays which protect the main or reserve portions only. The purpose of this "totalizing" relay is to protect such portions of the main connections as the line side oil circuit breaker bushings, which could only be de-energized by killing both the main and reserve portions. The main or reserve portions are allowed to trip first, in the hope that the fault may be cleared without killing both main and reserve portions.

The most striking difference between the Waterman and the Columbia fault protection is the metal-inclosed and insulated feature of the former. The Columbia fault bus is laid directly on the concrete cell structure, and although pains were taken during construction to keep the oil circuit breaker mountings and bus anchors clear of the building steel and reinforcing rods, quite a few foreign grounds had to be cleared up before the fault bus could be put in operation. Therefore, the Waterman installation seems not only to have the advantage of minimizing the chance of phase-to-phase short circuits, but the fact that the bus and switch structures are mounted on insulators would make it much easier to install without foreign grounds developing.

We, in Cincinnati, do not feel that the expense of installing an individual tripping relay for each circuit is justified. The thought that all your eggs are in one basket and that the accidental closing of one relay will clear your bus section is not a happy one. To insure against this happening at Columbia, the coil circuit of the auxiliary relay which trips the various groups of oil circuit breakers is in series with not only the fault bus relay contacts but also with the contacts of another relay which is supplied with current from the generator neutral bus. Thus both relay contacts must be closed for the fault bus protection to operate, and this cannot happen unless a ground fault exists on the 13.2-kv. system.

At Waterman station the fault bus is regularly tested at 5,000 volts. Due to the type of construction at the Columbia station, a high potential test is not practical. However, the condition of the fault bus is tested once on every shift by measuring the insulation resistance to ground by means of a voltmeter and 110 volts d.c. A disconnect switch is mounted between the fault bus current transformer and the station ground bus, in order to isolate the fault bus for testing. For safety to the operator, the disconnect is shunted by a large capacity paper film cutout which breaks down at 250 volts, so that should a ground fault develop while the disconnect was open, no undue rise in voltage across it would occur. A permanently mounted switchboard type voltmeter, together with the necessary small toggle switches, is used to simplify the resistance measuring.

S. M. HAMILL, JR.,
Assistant Superintendent Electric Operating Department.
Union Gas & Electric Company,
Cincinnati, Ohio.

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Electric Heat in Electrotype Plant

To the Editor of the ELECTRICAL WORLD:

On pages 754 and 755 of the ELECTRICAL WORLD for April 12, 1930, you published an abstract of an article written by me.

I wish to correct a statement which is made in the last paragraph of this article. It reads: "About 4,500 lb. of metal can be melted in this pot in about 40 minutes." It should read: "About 2,100 lb. of metal can be melted in this pot in about 40 minutes."

Ohio Power Company,
Lima, Ohio.
IRA J. BARBER.

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"Cash Bonuses Increase Individual Productiveness"

To the Editor of the ELECTRICAL WORLD:

In the ELECTRICAL WORLD for May 24, page 1022, I was delighted to see the editorial on cash bonuses.

In our steam specialty business we have found cash bonuses, based on results, highly effective in increasing the productiveness of individuals. This has been so to such an extent that we believe that cash bonuses paid are created largely or wholly "out of the air" and that the actual cost, therefore, to the company paying them is nil.

Others, I believe, are having the same experience, and I think it is certain that the giving of bonuses is rapidly increasing for the above reason.

Introduction of this system into the public utility concerns seems likely to bring equally beneficial results, and I trust you will be able to point to conspicuous successes in such plans among your readers before long.

You are making a substantial contribution to economic and ethical progress by pointing out the situation as you have done in the above-mentioned article.

Yarnall-Waring Company,
Philadelphia, Pa.
B. G. WARING.

Men of the Industry

Dr. Kahlenberg Heads American Electrochemical Society

DR. LOUIS KAHLENBERG, who was recently elected president of the American Electrochemical Society, has been engaged in chemical research work for a number of years and at the present time is professor of chemistry at the University of Wisconsin. A native of Two Rivers, Wis., and a graduate of the University of Wisconsin, he joined the

teaching staff of his alma mater immediately after graduation, and with that institution he has remained during his entire professional career. Dr. Kahlenberg has written many monographs and articles in numerous technical publications on chemical subjects, especially researches on solutions, electrolysis and osmosis. He is a fellow of the American Society for the Advancement of Science, a member of the American Chemical Society, the Wisconsin Academy of Sciences, Arts and Letters, of which he was president from 1906 to 1909, and of other similar associations.

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DR. CHARLES WEYL, assistant professor of electrical engineering at the University of Pennsylvania, was recently made the recipient of the Longstretch medal by the Franklin Institute.

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CHARLES F. SCOTT, professor of electrical engineering at Yale University, was awarded the Lamme medal at the convention of the Society for the Promotion of Engineering Education, held recently in Montreal. The medal is awarded by the society each year to a chosen technical teacher for accomplishment in technical training or actual advancement of the art of technical training.

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DANA PIERCE, president of the Underwriters' Laboratories, Chicago, has been made the recipient of the degree of doctor of engineering by the Armour Institute of Technology in recognition of his contribution to engineering progress in the fire protection field.

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CLARENCE F. HIRSHFELD, chief of research of the Detroit Edison Company, has been appointed chief engineer of the President's Conference Committee of the American Electric Railway Association intrusted with the work of expediting the development of the urban railway car.

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ARTHUR W. BERRESFORD, managing director of the National Electrical Manufacturers' Association, was presented on July 9 with the first prize of the Phebe Hobson Fowler professional award, as a recognition of his excellent work as president of the American Engineering Council during the past two years. The presentation ceremony took place at Cleveland, Ohio, in connection with the annual convention of the American Society of Civil Engineers. The prize, a gold medal and certificate, was presented by J. F. Coleman, president of the society. Second prize was awarded to J. Vipond Davies, president of Jacobs & Davies, Inc., in recognition of his accomplishments as chairman of the A.S.C.E. committee on charges and methods of making charges for professional services.

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R. F. BUCKNAM of the Department of agriculture and economics of the State College of Agriculture at Cornell University has been appointed to head the new rural electrification work of the Public Service Commission of the State of New York. Mr. Bucknam is well and favorably known for his researches in this field, both by the farmers and electric utility companies. For four years he has been making studies of rural line extension plans and rates, working with electric utility companies to promote better extension plans and rates for farmers. Rural electrification work by the Public Service Commission was specially authorized by the Legislature in a bill introduced by Senator Thayer and approved by Governor Roosevelt last winter.

Eugene Holcomb Heads Great Lakes Division

EUGENE HOLCOMB, new president of the Great Lakes Division of the National Electric Light Association, has long been identified with the central-station industry. Born in Michigan, he took Horace Greeley's advice and went West, where he became associated with the Thomson-Houston Company in California in 1888, later becoming as-

sistant district engineer for the Edison General Electric Company at Portland, Ore. Mr. Holcomb became a partner in the McCaskey & Holcomb Company, operating the Capital Electric Company at Springfield, Ill., retaining this position from 1895 to 1902. After a three-year period on foreign soil as representative of the Westinghouse Electric & Manufacturing Company at Buenos Aires, he returned to the United States in 1905 as vice-president of the Northern States Power Company at St. Paul, Minn. His next move was a return to his home state as general manager of the electric utility at Alma, Mich. When this property was taken into the system of the Consumers Power Company he was put in charge of the rural development work of that company, which position he now holds. Mr. Holcomb has devoted considerable attention to association work.

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L. H. KNAPP has been appointed chief industrial service engineer of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I.

K. I. Dazey Heads New Electrical Association

K. I. DAZEY, who for the past two years has been general manager of the Southern Oregon Gas Corporation, has been appointed managing director of the new organization formed to unify various promotional groups in the electrical industry in California. As announced in the May 31 issue of the ELECTRICAL WORLD, the name of the organization has not been decided upon.

Mr. Dazey's past experience in public utility work and his varied service in civic and co-operative activities make particularly fortunate his choice for the work that awaits him in so important a

contribution to the welfare of the electrical industry in California. During eleven years spent in the employ of the Pacific Gas & Electric Company he worked under the direct supervision of A. F. Hockenbeamer, president of that company, and during this period he developed a broad conception of power company policy.

Mr. Dazey assumed his new duties on June 1, and on July 1, when the recent resignation of Samuel H. Taylor, who has served as secretary of the Pacific Coast Electrical Association for the past ten years, became effective, Mr. Dazey also succeeded to the office of secretary of the association. Mr. Taylor is one of the pioneers of the electrical business. With the culmination of his service to the Pacific Coast association his connection with the industry numbered 56 years.

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N. H. COIT, for the past nine months general manager of the Broad River Power Company, has been elected vice-president, assuming the title of vice-president and general manager. He was formerly general manager of the Florida Public Service Company. After some engineering experience in the West, Denver being his native city, Mr. Coit entered the employ of the General Gas & Electric Corporation, of which the Broad River utility is a subsidiary, in 1923. For one year he acted as assistant commercial manager of the Pennsylvania Edison Company at Easton and when the General Gas & Electric Corporation entered central Florida in 1924 he was sent to Orlando. He served as general superintendent for a year, was promoted to general manager and then in 1929 he was transferred to Columbia.

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JOHN T. BRODERICK, secretary of the manufacturing commitee of the General Electric Company, retired from active service July 1, concluding 41 years of continuous service with that organization. Mr. Broderick joined the Thomson-Houston Company at Lynn, Mass., in 1889, as one of the factory staff of E. W. Rice, Jr., then superintendent of the plant.

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OBITUARY

William N. Ryerson

WILLIAM M. RYERSON, president of the Trojan Engineering Corporation, New York, died July 7 in his fifty-seventh year, after an illness of six weeks. A native of New York City and a graduate of the Columbia University School of Mines, Mr. Ryerson specialized in electrical engineering. He spent some time in the transportation field before becoming assistant superintendent of construction for the Niagara Construction Company, about the time some of the big hydro developments on the Canadian side of Niagara Falls were started. Subsequently he became superintendent of construction for the Ontario Power Company, Niagara Falls, Ont., which position he held until 1909. Then he transferred his interests to Duluth, Minn., as general manager and chief engineer of the Great Northern Power Company. He was in this position for more than thirteen years, and it was here that he became well known among the light and power companies of the country, serving on several committees of the National Electric Light Association. About the time the Duluth properties were acquired by the Electric Bond & Share Company Mr. Ryerson left to form a connection with Day & Zimmermann of Philadelphia as assistant manager of the public utility management department, where he supervised the details of operation of all the utility properties, budgets, new business, rates, public relations, accounting and major construction progress. In January, 1925, the United Gas Improvement Company of Philadelphia made him assistant to vice-president, in charge of operations and engineering. His duties involved supervision of operations of gas and electric properties, budgets, rates and engineering projects. When the Trojan Engineering Corporation was organized in September, 1928, Mr. Ryerson became its president, which position he held at the time of his death. Mr. Ryerson had been an active committee worker for the National Electric Light Association, was a fellow of the American Institute of Electrical Engineers, a member of the American Society of Mechanical Engineers and was for two years president of the Canadian Electrical Association.

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Waldo C. Bryant

WALDO C. BRYANT, well-known inventor and chairman of the board of directors of the Bryant Electric Company, Bridgeport, Conn., died July 5 in Colorado Springs, Colo. Troubled with grip and cold, Mr. Bryant had gone west two weeks ago in the belief that the mountain air would improve his health. It was discovered at a local hospital that he was suffering from an embolism and an operation on his intestines was performed. He was 66 years of age. A pioneer electrical manufacturer, Mr. Bryant built the company of which he was head from a small organization, capitalized at $5,000, to a business of $3,000,000, employing 2,000 persons and dealing in the manufacture of sockets, switches and wiring devices, with offices in New York, San Francisco and Chicago.

A native of Winchendon, Mass., and a graduate of the Worcester Polytechnic Institute, he entered the employ of the Thomson-Houston Electric Company at Lynn and was soon transferred to Bridgeport and later to Waterbury, Conn., as assistant operator of the local electric lighting plant. Following his invention of the Bryant push-and-pull switch in 1888, he returned to Bridgeport and began the manufacture of electric lighting supplies under the name of the Bryant Electric Company. He sold his holdings to the Westinghouse interests in 1921, but remained as president and general manager until 1927, when he became chairman of the board. Mr. Bryant was a member of the American Institute of Electrical Engineers and a valued adviser in many banking, industrial and philanthropic organizations.

Financial and Statistical News

SECURITIES markets continue to depend largely on professional trading, with daily volume at low levels. Attempts to revive public buying are exerted almost daily in the form of rumors that the "big interests" are just about to step into the market.

——UTILITIES COMMON STOCKS MEANWHILE HAVE SUFFERED heavily from bear attacks and brokers point to this group as having the potentialities required to lead the rise when buying volume returns. Naturally this depends on the new ideas of values which the investing public is developing. Actual and potential earnings and management are being more carefully studied.

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Merger in Ohio Approved

THE OHIO PUBLIC UTILITIES COMMISSION has just authorized the merger of Ohio utility companies in accordance with the terms set forth in the June 14 issue of the ELECTRICAL WORLD, page 1190. The merged companies will have a total capitalization of $135,285,000. The new corporation, Ohio Edison Company, will be a direct subsidiary of the Commonwealth & Southern Corporation.

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Reorganization on Pacific Coast Completed

CORPORATE REORGANIZATION OF PROPERTIES recently acquired by the Pacific Gas & Electric Company from the North American Company was completed at a meeting of the Great Western Power Company of California held July 2. The following officers were elected: President, A. F. Hockenbeamer; vice-president and general manager, P. M. Downing; vice-president and assistant general manager, A. Emory Wishon; secretary and treasurer, D. H. Foote, and comptroller, E. W. Hodges. All of these officers are directors except Mr. Hodges. Additional directors include Frank B. Anderson, Charles L. Barrett, Allen L. Chickering, John P. Coghlan, F. T. Elsey, Guy C. Earl, C. O. G. Miller, T. J. Straub and A. G. Wishon. The same officers were elected for subsidiaries of the Great Western Power Company of California, namely, Great Western Power Company, California Electric Generating Company, City Electric Company, Napa Valley Electric Company and Feather River Power Company.

San Joaquin corporation officers are as follows: A. F. Hockenbeamer, chairman of the board; A. G. Wishon, vice-chairman; A. Emory Wishon, president; P. M. Downing, vice-president; D. H. Foote, secretary and treasurer; E. P. Smith, assistant to president; W. E. Durfey, vice-president and assistant secretary and assistant treasurer; E. W. Hodges, comptroller. Directors are the same as those of the Great Western Power with the exception of E. P. Smith, who takes the place of T. J. Straub. The officers for the San Joaquin subsidiaries are the same as for parent company. The subsidiaries are Midland Counties Public Service Corporation, Bakersfield and Kern Electric Railway Company and San Joaquin Light & Power Company.

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Recent Listings

NEW YORK STOCK EXCHANGE has authorized the listing of 250,000 additional shares of $6 cumulative preferred stock of the American & Foreign Power Company on official notice of issuance and payment in full, making the total amount of $6 preferred stock applied for 449,310 shares.

There have also been authorized for listing 146,828 additional shares common stock of the North American Company on official notice of issuance as a stock dividend, making a total of 6,609,415 shares applied for. The New York Stock Exchange has recently authorized the listing of 710,000 additional shares of $3 cumulative preference stock and 3,195,000 additional shares of common stock of the United Corporation and 523,314 additional shares of common and 8,820 additional shares of cumulative preferred stock of United Gas Improvement Company.

The Big Board will also soon list 35,000 shares of class A stock of the Utilities Power & Light Corporation.

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$25,000,000,000 in Electric Light and Power

THE WORLD'S total electrical energy output for 1929 is estimated at 300,000,000,000 kw.-hr. and the investment in the electric light and power industry at $25,000,000,000 or more. The tables give approximate figures for those individual countries for which estimates can be made on the basis of available information.

Only a few countries publish statistics of electrical output, and even these are not always comparable. Some include energy privately generated in connection with industrial establishments, others report only the output of public utility plants. In the present compilation an effort has been made to embrace the output of all agencies.

Estimated Energy Output* in 1929

Country	Kw.-Hr. Millions	Country	Kw.-Hr. Millions
United States	125,000	Australia	1,900
Germany	34,000	Czechoslovakia	1,700
Dom. of Canada	18,000	Mexico	1,400
Great Britain	16,200	Holland	1,400
France	15,500	Brazil	1,200
Japan	11,500	Argentina	930
Italy	9,800	Hungary	750
Norway	8,500	Chili	400
Russia	6,500	Cuba	300
Switzerland	5,520	Denmark	300
Sweden	5,000	Uruguay	125
Belgium	4,486	Ireland	100
China	3,050	Peru	80
Spain	3,000	Lithuania	15
Poland	2,600	Iceland	10
Austria	2,500		
Union of South Africa	1,900	Total for countries listed	283,666

Estimated Investments in Electric Light and Power Industry,* 1929

Country	Investment, Millions	Country	Investment, Millions
United States	$11,045	Australia	75
Germany	2,700	New Zealand	60
Great Britain	1,500	Hungary	50
Canada	1,000	Ireland	26
Italy	945	Uruguay	15
Japan	600	Lithuania	2
Switzerland	312		
Denmark	150	Total for countries listed	$18,805
Mexico	130		
China	110		
Union of South Africa	85		

*From "World Survey of Electric Power," Bynchon & Company.

Utilities Issue Substantial Offerings

DURING THE WEEK ended July 10 the electric light and power companies of the country offered several sizable issues, the largest of which was a fifteen-million-dollar offering by the Public Service Company of Northern Illinois. The issue was in the form of first lien and refunding mortgage 4½ per cent bonds, series E, priced at 94 and interest, yielding about 4.82 per cent. Proceeds from the sale of the bonds will be used to reimburse the company in part for expenditures made and to provide funds for extensions and additions to be made to the company's transmission and distribution system.

Another Insull company was represented in the week's new offerings. The Commonwealth Edison Company issued first mortgage collateral 4½ per cent gold bonds, series E, at 97.50 and interest, yielding about 4.65 per cent, a piece of financing involving a total of $12,000,000. Proceeds will be used to reimburse the company in part for capital expenditures heretofore made in the development of its properties.

City of Seattle, Washington, municipal light and power 4¾ per cent gold bonds were offered the investing public to the amount of $2,500,000 at prices to yield 4.85 per cent. Proceeds of this issue will be used for construction purposes and for the extensions to and betterments of the existing system.

Two-year 6 per cent convertible secured gold notes of the East Coast Utilities Company were issued at 100, the issue totaling $900,000.

Wisconsin Power & Light Company made an offering of first lien and refunding mortgage 5 per cent gold bonds, series F, to the amount of $4,000,000, the price being 99 and interest.

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NEWS BRIEFS

Public Utility Holding Corporation has acquired a 35 per cent interest in the Compagnie Grand d'Electricité du Luxembourg, a construction and distributing company that is undertaking the electrification of the entire Grand Duchy of Luxembourg. Senator Albert Mahieu of France is president of the Luxembourg company and, together with M. Lousteau, is identified also with L'Union Electrique Rurale, in which Public Utility Holding recently acquired a minority interest.

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New England Power Company, Boston, Mass., has been given authority by the Public Utilities Commission to issue additional capital stock of a par value of $1,333,325. Proceeds of the stock are to be used solely for the payment and cancellation of obligations.

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The Canadian Hydro-Electric Corporation, Ltd., produced 218,850,000 kw.-hr. of electric energy in May, a new high record for a single month and an increase of 2 per cent over the previous high record for a month, established in April, and over 2¼ times that of May, 1928.

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First and refunding 4½ per cent bonds of 1970 of the Public Service Electric & Gas Company of New Jersey have been added to the list of securities legal for investment by savings banks recently revised by J. A. Broderick, State Superintendent of Banks of New York.

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CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

	1930	1929	Per Cent Increase	Operating Ratio 1930	Operating Ratio 1929
Alabama Power & Subs.* (Year ended May 31)					
Gross earnings	$18,042,247	$17,744,498	1.7	41	37
Net earnings	10,655,931	11,274,753	—5.5	..	..
American & Foreign Power (Year ended April 30)					
Gross earnings	71,710,812	39,988,673	79.0	..	..
Net earnings	35,699,959	20,611,084	73.0	..	..
American Water Works & Electric & Subs. (Year ended May 31)					
Gross earnings	54,958,419	52,007,417	5.7	50	50
Net earnings	27,316,405	25,736,892	6.1	..	..
Arkansas Power & Light (Year ended May 31)					
Gross earnings	8,678,904	7,580,841	14.0	52	52
Net earnings	4,123,981	3,626,879	14.0	..	..
Associated Gas & Electric System (Year ended May 31)					
Gross earnings	105,043,072	57,140,821	84.0	50	55
Net earnings	52,628,644	26,013,699	102.0	..	..
Cities Service (Year ended May 31)					
Gross earnings	54,464,046	37,618,672	44.8	..	..
Net earnings	52,804,197	36,423,179	44.0	..	..
Commonwealth & Southern (Year ended May 31)					
Gross earnings	33,293,699	32,151,668	3.5	48	49
Net earnings	17,279,724	16,311,147	5.9	..	..
Consolidated Gas, Electric Light & Power Co. of Baltimore (Year ended May 31)					
Gross earnings	28,464,656	26,872,552	5.9	58	58
Net earnings	11,846,915	11,128,415	6.5	..	..
Eastern Texas Electric & Subs. (Year ended May 31)					
Gross earnings	10,035,293	8,777,391	14.3	..	..
Net earnings	4,177,365	3,673,970	13.7	..	..
Eastern Utilities Associates (Year ended May 31)					
Gross earnings	9,373,722	8,909,290	5.2	..	..
Net earnings	3,772,918	3,479,707	8.5	..	..
Engineers Public Service & Constituent Cos. (Year ended May 31)					
Gross earnings	51,848,289	40,894,038	26.7	57	58
Net earnings	22,327,799	17,297,785	29.1	..	..
Federal Light & Traction & Subs. (Year ended May 31)					
Gross earnings	8,453,151	8,230,043	2.7	53	59
Net earnings	3,608,083	3,373,458	7.0	..	..
Galveston-Houston Electric & Subs. (Year ended May 31)					
Gross earnings	5,086,463	5,262,637	—3.3	..	..
Net earnings	1,599,716	1,719,689	—6.9	..	..

	1930	1929	Per Cent Increase	Operating Ratio 1930	Operating Ratio 1929
Georgia Power & Subs.* (Year ended May 31)					
Gross earnings	$22,826,071	$24,053,700	—5.1	48	47
Net earnings	11,952,239	12,630,617	—5.4	..	..
Kansas City Power & Light (Year ended May 31)					
Gross earnings	14,629,361	14,172,970	3.2	49	51
Net earnings	7,381,671	6,954,915	6.1	..	..
Kansas Gas & Electric (Year ended May 31)					
Gross earnings	6,025,661	5,521,463	9.0	53	54
Net earnings	2,846,206	2,556,412	11.0	..	..
Louisiana Power & Light (Year ended May 31)					
Gross earnings	5,676,351	4,415,533	29.0	52	52
Net earnings	2,715,124	2,125,710	28.0	..	..
Minnesota Power & Light (Year ended May 31)					
Gross earnings	6,323,252	6,177,857	2.0	38	35
Net earnings	3,885,541	4,002,759	—3.0	..	
Nebraska Power (Year ended May 31)					
Gross earnings	6,246,998	5,579,767	12.0	50	49
Net earnings	3,141,829	2,722,798	15.0	..	..
Nevada-California Electric & Subs. (Year ended May 31)					
Gross earnings	5,770,409	5,458,982	5.7	49	46
Net earnings	2,945,219	2,963,086	—0.6	..	..
Puget Sound Power & Light & Subs. (Year ended May 31)					
Gross earnings	16,861,462	15,618,159	7.9	..	..
Net earnings	7,144,927	6,478,613	10.3	..	..
Southern California Edison (Year ended May 31)					
Gross earnings	40,799,162	36,961,058	10.0	33	35
Net earnings	27,190,938	24,077,768	13.0	..	..
Tennessee Electric Power & Subs. (Year ended May 31)					
Gross earnings	15,280,574	13,811,266	10.6	51	51
Net earnings	7,535,195	6,760,704	11.4	..	..
Texas Power & Light (Year ended May 31)					
Gross earnings	9,923,311	9,592,190	3.0	51	50
Net earnings	4,897,675	4,772,312	3.0	..	..
Utah Power & Light (Year ended May 31)					
Gross earnings	11,740,834	11,347,902	3.0	51	49
Net earnings	5,744,186	5,814,001	—1.0	..	..
Virginia Electric & Power & Subs. (Year ended May 31)					
Gross earnings	17,172,693	16,636,010	3.2	..	..
Net earnings	7,785,285	7,358,664	5.8	..	..

*Figures for 1929 include operations of gas properties sold May 1, 1929.

June Manufacturing Slightly Under May

JUNE witnessed a decrease in the rate of manufacturing operations of less than normal seasonal proportions. The rate of general manufacturing in the country as a whole during June was only about 2.9 per cent under May, whereas a 4.8 per cent decrease is normal for this period. The June operations, however, were 14.6 per cent under June last year and were at the lowest rate recorded since December, 1927, according to reports on electrical energy consumption received by ELECTRICAL WORLD from some 3,800 manufacturing plants scattered throughout the country. The average rate of general manufacturing operations during the first half of the current year was 11.9 per cent under the same six-month period in 1929.

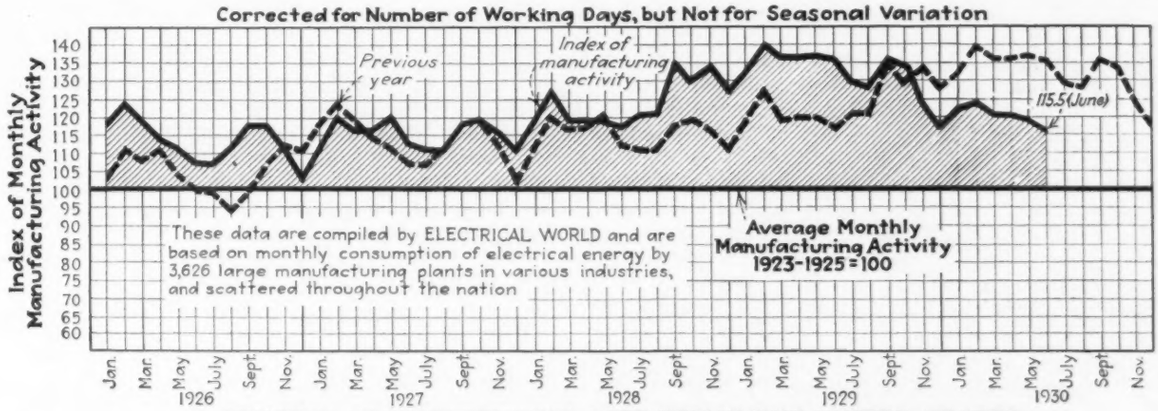
Every section of the country witnessed a decline in manufacturing operations during June as compared with May and every section was also operating on a plane materially under June last year. The greatest curtailment of manufacturing operations as compared with last year is being witnessed in New England, with a decrease of 23.7 per cent under June, 1929, followed by the North Central States with a drop in activity of 17.7 per cent, the Middle Atlantic States 13.7 per cent, the Western States 8.6 per cent and the Southern States 6.9 per cent.

Several industrial groups appear to be witnessing decided upward tendencies. Leather products recorded a material increase in May, but is still operating under last year.

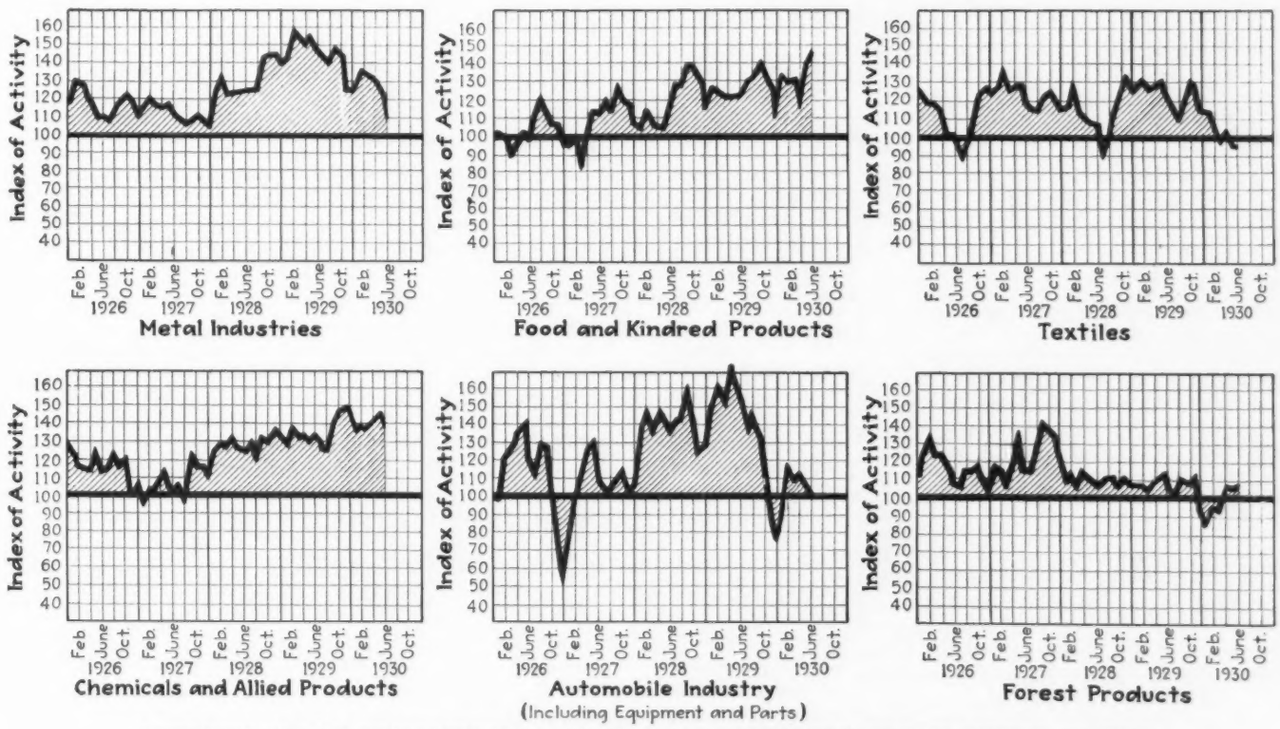
How Current Manufacturing Compares with that of Other Periods

(Nation as a Whole)

Industrial Group	June, 1930, and May, 1930	June, 1930, and June, 1929	First Half 1930 and First Half 1929
All industry	— 2.9	—14.6	—11.9
Chemical products	— 5.5	+ 3.6	+ 5.4
Food products	+ 5.2	+19.4	+ 7.0
Steel plants	—14.7	—25.4	—15.2
Metal-working	— 8.2	—25.5	—15.9
Leather products	+46.0	— 1.9	— 9.2
Lumber products	+ 4.8	— 5.7	— 9.8
Paper and pulp	+ 4.0	same	+ 0.8
Rubber products	—22.6	—33.7	— 9.8
Shipbuilding	— 1.2	+ 4.6	+ 9.2
Stone, clay and glass	+12.6	—19.8	—15.4
Textiles	+ 0.7	—29.1	—20.9
Automobiles	— 7.3	—35.5	—31.8


Corrected for Number of Working Days, but Not for Seasonal Variation
Index of Monthly Manufacturing Activity
Previous year
Index of manufacturing activity
115.5 (June)
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Average Monthly Manufacturing Activity 1923-1925=100
1926
1927
1928
1929
1930

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Markets

Normal Business By October*

By VIRGIL JORDAN
Economist "The Business Week"

BUSINESS during the present depression, particularly in the past three months, has suffered a more pronounced shell shock than seems to have been caused in any previous business depression. Fundamentally, that shell shock arises from the fact that individuals have had to make some very quick and pronounced adjustments to a new state of conditions which they are not able to understand very clearly, or adapt themselves to very quickly. We have had eight years of very exceptional business, perhaps the longest period of super-prosperity that we have ever seen, and that has brought the community to a way of thinking that is very hard to rearrange quickly. It has built up a belief about business that needs to be readjusted and which is very difficult to readjust. The real problem that faces the country is reorienting itself to existing business.

The first question that confronts any one today is: "Is this going to be a long business recession similar to those of the past? Not even similar to 1921, but similar to those recessions in the nineteenth century." My answer to that question is very flat and straightforward, and it is "No." This is not going to be a long business recession. It began at the end of July, 1929, so we have had nearly a full year of subnormal business. That is a long time as modern business goes.

Business exceeds 1893 pace

Business today goes at a faster clip than it did in 1893. Today we have the facilities by which business throughout the world, and certainly throughout the United States, can get rather successfully in touch with the trend of the times from day to day and certainly from week to week. Although there remain individuals who do not have adequate methods of communication, nevertheless, generally speaking, the country is able to get in touch with current developments very much faster.

All of these depressions, except the one in 1921, took place before we had a well-organized national banking system. The Federal Reserve System is still a very useful citizen of the United States. In 1921 it had not learned a good many lessons that it has learned since. This banking system is a much better guide than it was five years ago and is another factor strongly pointing in the direction of a shorter business depression.

In the older business recessions there is no question but that the United States was very much out of touch with the whole world and exercised a much smaller influence upon the state of business the world over than the United States does today.

The balance of economic forces today rests here in the United States. The national income of the United States is probably greater than that of all the rest of the world put together. So that a change up or down of 10 per cent in the temperature of the United States affects the business temperature of the whole world. This world-wide depression originated in the United States, and the recovery, likewise, is going to start here and going to spread over the world. That recovery is not going to start here in New York. In fact, the center of force of world recovery actually lies back in the hinterlands of the United States, where close contact with our natural resources builds the foundation upon which can be applied the lever of recovery. I think we are going to see that the process is going to start back not only in the Middle West but farther back than that.

How long is the depression going to last? My forecast is simply this, that the lowest point was probably reached during the past two weeks (prior to June 27). During the next four weeks I do not expect to see any particular change in that tide. That is the whole difficulty in the present situation; that the process of liquidation which has been going on for practically a year, starting very fast, then running down, has changed its complexion. The liquidation continues through a great mass of business activities, but underneath it one can see signs gradually of individual resistance and firmer speculation in particular fields or in particular localities as well. During the next four weeks the acute observer who is looking for them will be able to see signs here and there that business is picking up. And by the end of July or early August, almost exactly a year after the down-turn began, I believe that we are going to see the process of recovery set in very definitely and sufficiently widespread to be observable by the business community.

Credit conditions wholesome

By October our general business curve will be back to the normal line. The fundamental factor is the wholesome credit condition in which our banking system is at present. Fundamentally, those who have seen processes of business revival or business decline know fairly well that the basic factor in a rise in business or in a decline of it is the rate of credit expansion throughout the country. That rate of expansion normally goes on at about 4½ per cent per year, which, by the way, is almost exactly the same as the normal rate of expansion of the total volume of business, so that if those two are going along together at that constant rate, we have what we call stable prices and stable business We have never seen them hold for long periods, because the rate of credit expansion seems to get out of step—going ahead too fast or too slow.

After March the rate of credit expansion, which had been going down pretty early a year ago began to turn up and is now nearly at normal. Under these conditions, unless all our ideas of economics are entirely wrong, there is no way in which business can resist that steady expansion.

There are fairly clear signs that residential building construction is due to turn upward. It has done so only very slowly and tentatively during May, which amounts merely to the fact that decline in building construction has been going on for 24 months, and building construction did not decline in May nearly as much as normal seasons. In connection with that there are direct evidences from some of the mortgage companies and building loan associations that residential construction has picked up markedly in the last few weeks. We cannot have any remarkable improvement until that signal has been displayed.

We read week by week of the gen-

**From an address before members of the McGraw-Hill staff.*

eral figures of actual car loadings making a very poor showing as compared with the last few years, but we fail to notice what is happening to those actual loadings. I think the evidence that some changes have taken place is that actual loadings in the Southwest in May were larger than they were in May, 1929. One would not have expected them to have been as large as May, 1929, at all, but that they should actually be above last year's loadings when last year was at the peak is exceedingly significant, to my mind.

Difficulties in the Way

Though business should be back to the normal line by October, does that mean that we shall have everything rosy again so that we can get back and start out with the same attitude toward business problems? Again, emphatically I do not think so. I think the inherent strength of the country will be able to pull out of a serious business recession more quickly than we have in the past, but I do not believe that those factors are going to enable us to repeat what we have done during the past eight years indefinitely.

After the recovery from this business depression the pressure is going to be very keenly felt. We are going to have in many lines a lot of work to be done to clear away the wreckage of these past eight or nine years. That puts a direct challenge upon those who are trying to serve business to get them all to understand what forces are operating upon business. I think the greatest value of this business depression is that it has made us realize that our individual industries are profoundly affected by the general business situation and that problems grow out of and are the result of broader business forces. Hereafter, it seems to me, we cannot look to the technical problems of markets, etc., as things by themselves, but only as things that are related to the general business situation.

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Westinghouse Awarded State Line Contract

THE STATE LINE GENERATING COMPANY has awarded the contract for 25-kv. outdoor oil-filled, metal-clad switchgear for the control of the second section of the State Line generating station to the Westinghouse Electric & Manufacturing Company. This contract amounts to $1,250,000 and includes nineteen bays with 38 oil circuit breakers, 2,000 and 3,000-amp. continuous current carrying capacity, having 2,500,000-kva. interrupting capacity at 25,000 volts, for the control of nineteen feeder generator and bus tie circuits.

Schweitzer & Conrad Merges with Cutler-Hammer

ANNOUNCEMENT IS MADE by Cutler-Hammer, Inc., Milwaukee, Wis., that on July 1 it acquired all common stock of Schweitzer & Conrad, Inc., Chicago, manufacturer of high-voltage equipment. Schweitzer & Conrad will continue to operate as an independent manufacturing and selling unit. No changes in organization or personnel will be made except that Beverly L. Worden, president of Cutler-Hammer, has also been elected president of Schweitzer & Conrad.

Mr. Conrad and Mr. Schweitzer have been retained as consulting engineers and will continue their interest in the management as members of the board of directors.

Other members of the new Schweitzer & Conrad board are F. R. Bacon, who is chairman of the Cutler-Hammer board, and F. L. Pierce and Louis A. Lecher, who are also members of the Cutler-Hammer board.

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General Electric Orders Show Drop

ORDERS RECEIVED BY THE General Electric Company for the second quarter of 1930 amounted to $99,916,027, compared with $119,351,248 for the corresponding three months of last year, according to an announcement by Gerard Swope, president of the company.

For the six months ended June 30 orders received amounted to $190,313,758, compared with $220,716,456 for the first six months of last year.

As a result of the transfer of the radio set and tube business outlined in the 1929 annual report, orders received in 1930 do not include radio sets or tubes.

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Sinclair Refining Buys Westinghouse Equipment

THE SINCLAIR REFINING COMPANY, Wellsville, N. Y., has purchased for installation in its new power house the following equipment manufactured by the Westinghouse Electric & Manufacturing Company: Two 750-kw., 80 per cent power factor, 2,300-volt, three-phase, 60-cycle generators with imbedded thermocouples for measuring internal temperatures and with direct-connected exciters, two 150-hp., 327-r.p.m., 2,200-volt, three-phase, 60-cycle, 80 per cent power factor, type HR synchronous motors for driving air compressors, two motor-generator sets to provide field excitation for the above-mentioned motors, two 175-hp., 328-r.p.m., 220-volt, three-phase, 60-cycle, 80 per cent power factor, type HR synchronous motors for driving air compressors, two motor-generator exciters for these motors, two magnetic, full-voltage starters for the 175-hp. motors, and complete switching equipment for this apparatus.

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Manhattan Electrical Supply Control Changes

ANNOUNCEMENT IS MADE THAT American Machine & Metals, Inc., has succeeded to the business of Manhattan Electrical Supply Co., Inc., and that C. K. Woodbridge of Prince & Whitely, formerly president of the Dictaphone Corporation and of the Kelvinator Corporation, succeeds Richard H. Brown as president of American Machine & Metals, Inc. The board of directors includes, in addition to Mr. Woodbridge, George von Seebeck, Ralph L. Day, Stanley M. Bachman, Col. M. J. Whitson and Harrison Johnson.

The officers and board of directors of the American Machine & Metals, Inc., will continue to operate the subsidiary companies in co-operation with the operating executives and contemplate such improvement and extension of the several businesses as will make for better products and service.

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TRADE BRIEFS

Wagner Electric Corporation of St. Louis, Mo., announces the combination of the sales office and service station for the Atlanta, Ga., territory and the installation of both in a new fireproof building.

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F. E. L. Whitesell has joined the Burndy Engineering Company, Inc., in the capacity of director of sales with offices in New York City. Mr. Whitesell was formerly with the Railway & Industrial Engineering Company for a period of ten years.

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New York Metal Prices

	July 2, 1930 Cents per Pound	July 9, 1930 Cents per Pound
Copper, electrolytic	11⅛	11⅛
Lead, Am. S. & R. price	5¼	5¼
Antimony	7	7
Nickel, ingot	35	35
Zinc, spots	4½	4.45
Tin, straits	30¼	29½
Aluminum, 99 per cent.	23.30	23.30

Market Conditions

EQUIPMENT business in the Eastern district is remarkably dull, with new orders easing off. Little definite improvement is anticipated for 30 to 60 days. Pacific Coast orders for equipment, wire and line material are better than anticipated and August is expected to be about normal.

——NEW ENGLAND SHOWS DEFINITE SIGNS OF IMPROVEMENT in many directions, but there is little tangible evidence of increasing business.

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MIDDLE WEST

—VERY LITTLE CHANGE IN BUSINESS *is noticeable this week in the Middle West section. Some improvement is noted in the employment situation, while industrial activity is somewhat better. While some recessions are observed, the major activities, steel, railroad, automotive and electrical, are in about the same position this week as heretofore.*

—CAR LOADINGS HAVE DECREASED *considerably, but despite this fact a feeling of optimism is becoming more evident. The successful settlement of the traction question in the Chicago district it is hoped will stimulate general business in the near future. The various utility companies are keeping abreast of conditions, conservatively proceeding with necessary extensions and construction.*

Some of the interesting orders placed this week include one for 1,000,000 lb. of ingot copper, one multi-panel 40,000-cu.ft.-per-minute air filter, "Mazda" lamps valued at $150,000 and several construction orders aggregating $100,000. Some increase in industrial business is noted, although general conditions remain spotty. There has been a fair demand for most appliances with an unusually good demand for electric refrigerators.

CONSTRUCTION PROJECTS

Wisconsin Valley Electric Company, Wausau, Wis., plans transmission line from Wausau to Chippewa Falls, Wis., to cost over $500,000. Michigan Steel Corporation, Ecorse, Mich., will carry out expansion program at mill to cost close to $700,000. Portland, Mich., will soon begin construction of municipal hydro-electric power plant to cost over $150,000. Indianapolis Power & Light Company, Indianapolis, Ind., plans power plant on Harding Street, and transmission line around city to cost about $2,000,000. Contracting Officer, Material Division, Air corps, Wright Field, Dayton, Ohio, will receive bids until July 21 for 130,000 ft. of lighting and power cable and 155,000 ft. of ignition cable. Central West Public Service Company, Omaha, Neb., plans transmission line at Buffalo Gap, S. D., and vicinity. Pierre, S. D., plans extensions and improvements in municipal power plant to cost $125,000. Cyrus, Minn., will receive bids until July 15 for equipment for a municipal power plant. Iowa Railway & Light Corporation, Cedar Rapids, Iowa, will soon take bids for power plant at Nevada, Iowa, to cost $225,000.

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NEW ENGLAND

—THE GENERAL SALES TREND *during the past week was steady. Orders for alternating-current network equipment for changes in distribution system were of interest. Sales of industrial equipment for the past week were steady with orders for small motors showing an even trend.*

Orders of interest were for several large power motors, including a 900-hp. motor for pumping power purposes and two 225-hp. motors for paper mill use. In addition a group of 23 motors was placed for individual drives in western Massachusetts. Negotiations are under way in turbo-generator departments and an encouraging trend for the coming months appears. General scheduled materials are selling well; orders for switch and control have been placed for four rotary converters.

Central-station supplies are spotty; transformer sales recently noted include a group to be used in new network installations; single unit sales for line extension have been encouraging and are maintaining an even level in volume. Substation equipment sales are uneven; negotiations are under way for a number of large groups of regulation and control apparatus. Insulator sales receded recently, but one distributor reports a steady demand for line materials.

CONSTRUCTION PROJECTS

Edison Electric Illuminating Company of Boston, has taken out a permit for an addition to power substation at East Boston. Worcester Electric Light Company, Worcester, Mass., has plans for a power substation to cost about $50,000. National Folding Box Company, New Haven, Conn., will build an addition to cost $175,000. State Board of Education, Hartford, Conn., has approved immediate erection of state trade school at Meriden, Conn., to cost $200,000.

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EASTERN

—THE GENERAL WEEK-END HOLIDAY *over the Fourth in practically all lines of business brought further decline in transactions for electrical equipment in the Eastern district. Coupled with advancing seasonal slackness and perceptibly lower industrial activities, commitments are reaching the lowest level of the year.*

—CENTRAL-STATION ACCOUNT *is inclined to move very cautiously and present demand is centered almost entirely in immediate requirements. Industrial account is becoming extremely dull, with prospects for revival at least 60 days distant. Electrical jobbers are passing through a slow period, and the turn of July shows more pronounced easing of orders.*

A leading manufacturer of heavy and light equipment says that electrical business from central stations and railroads is holding up well in gross volume, despite the tendency toward smaller orders; industrial account is falling off. A power company in the metropolitan district has placed a contract for a turbo-generator set with a New York manufacturer, costing $70,000. Another metropolitan central station has purchased motors to an amount of $40,000. An Oklahoma power utility is placing orders for a large outdoor power substation and steel tower transmission line, while a Missouri central station is awarding all miscellaneous contracts for an extensive hydro-electric power development.

The Westinghouse Electric & Manufacturing Company has secured an order from the government for propelling and condensing machinery for new cruisers now in course of construction at different yards, including four 250-kw. turbo-generators, all main and auxiliary air ejectors, propeller type blowers and other apparatus, totaling $1,500,000. A manufacturer of power equipment in New York and New Jersey reports capacity operations at two plants, with gross business for the past six months showing a gain of about 20 per cent over the corresponding period of a year ago. A manufacturer of air compressors in Pennsylvania is enjoying similar active account and has just closed an order with an oil company totaling close to $1,300,000; the two plants of the

company are running on maximum schedule, and expansion for increased output is scheduled.

A maker of electric switches at New York reports improved business for apartment house, school and public building installations; while inquiries are giving indications of slowing down, the outlook continues good.

CONSTRUCTION PROJECTS

Bakelite Corporation, New York, has authorized a power plant at proposed factory at Bound Brook, N. J., entire project to cost over $1,000,000. Solvay Process Company, Solvay, Syracuse, N. Y., plans expansion and improvement program in alkali manufacturing plant to cost $5,000,000. Buffalo General Electric Company, Buffalo, N. Y., has filed plans for a power substation on Summer Street. American Solvents & Chemical Company, New York, plans expansion and improvements in plant at Lawrenceburg, Ind., to cost over $250,000. New Jersey Power & Light Company, Asbury Park, N. J., contemplates transmission line in vicinity of New Brunswick, N. J. Driver-Harris Company, Harrison, N. J., will soon take bids for an addition to metal alloy plant to cost over $150,000. National Oil Products Company, Harrison, N. J., has filed plans for an addition to cost $200,000. W. J. Rainey Coal Company, Pittsburgh, Pa., will carry out an expansion and improvement program at coal-mining properties to cost over $500,000. Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until July 22 for electric-operated transfer units and spares for Eastern and Western yards (Schedule No. 3737), and at same time for voltmeters, ammeters, etc., for Philadelphia and Norfolk navy yards (Schedule 3740.)

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SOUTHWEST

—THE REPRESENTATIVES OF ALL MANUFACTURERS *interviewed agree that the excessive heat of the past week is largely responsible for the continued slowness in the movement in all electrical lines in this territory.*

No contracts of any consequence have been closed. The volume of stock sizes of motors and transformers has dropped far below normal. There is nothing unusual about this condition, however, as it is the regular midsummer slump.

CONSTRUCTION PROJECTS

Ralston Purina Company, St. Louis, Mo., has filed plans for addition to cereal mill to cost $200,000. Oklahoma Gas & Electric Company, Oklahoma City, Okla., plans equipment storage and distributing plant to cost about $100,000. Arkansas Light & Power Company, Pine Bluff, Ark., will install light and power system at Harrison, Ark., to cost $30,000. Texas Power & Light Company, Dallas, Tex., plans 60,000-volt transmission line from Waco to McGregor, Tex., with power substation. San Antonio Public Service Company, San Antonio, Tex., has plans for addition to power plant to cost $75,000. Baton Rouge, La., plans lighting system at airport, entire project to cost $100,000. Natchitoches, La., will receive bids until July 24 for addition to municipal light and power plant.

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PACIFIC COAST

—JULY, WHICH IS VIRTUALLY *a standardized vacation month for the trade, is regarded as a poor business period, but orders for conduit, wire, line material and machinery are much better than predicted and August is expected to be almost normal.*

—POWER COMPANY BUSINESS *has suffered, of course, through mergers which canceled nearly $20,000,000 projected plant work in one company alone, but necessity has continued much line construction.*

The past week's orders have included one carload each of crossarm braces, steel pins, steel guy strand, four carloads of crossarms, six carloads of poles and one carload of 4-in. fiber conduit. Machinery orders have included $30,000 worth of Westinghouse voltage regulators for Los Angeles, an $8,500 switchboard for station E, San Francisco, and considerable General Electric material for the new Monterey substation, comprising four 2,000-kva. transformers valued at $30,000 and a 250-hp. synchronous motor and equipment valued at $3,000. Industrial business is still poor, though an order for 250-hp. General Electric pumping control motors and supplies valued at $8,500 is reported from a sugar company's Berkeley plant and $30,000 worth of Westinghouse motors for a San Francisco shipbuilding company. The Western Pacific Company announces an early start on its Klamath Falls to Feather River link with the Great Northern and a 40-mile line from Niles across the bay and up into San Francisco. Industrial business, however, and the communities serving such industrials, has been hurt by such shut-downs as that of the lumber companies in Alturas and the caterpillar tractor plant in Oakland. Building construction has improved, especially in such specialized structures as two large churches for San Francisco, $1,250,000 motion-picture studio reconstruction in Los Angeles, a $750,000 skating ring for Sacramento, a $300,000 scientific academy and the $500,000 U. S. Government garage for San Francisco. Prices are steadier. The recent 10 per cent advance in rigid iron conduit caused a flood of covering orders.

Washington Electric Company, subsidiary of Puget Sound Power & Light Company, has awarded apparatus contracts in connection with its Rock Island development involving in excess of $800,000, as follows: Four 15,000-kw. generators, sixteen 667-kva., 13,800-volt transformers to General Electric Company, seven 10,000-kva., 13,800 to 115,000-volt outdoor type transformers to Westinghouse, two 3,000, two 2,000, four 1,200 and one 600-amp. oil circuit breakers to Westinghouse, to be delivered about June 1, 1931.

CONSTRUCTION PROJECTS

California Utilities Company, Susanville, Calif., plans power substation, to cost $80,000. Long Beach, San Mateo, Covina and Los Angeles, Calif., plan ornamental lighting systems. Multi-Color Films, Inc., Los Angeles, Calif., plans plant to cost over $300,000. Rouge River Box Company, Grants Pass, Ore., plans plant to cost $150,000. Ford Motor Company, Dearborn, Mich., is completing plans for assembling plant at Seattle, Wash., with power plant, to cost over $1,000,000. Yakima, Wash., plans ornamental lighting system. Plentywood, Mont., plans municipal electric light and power plant, to cost over $70,000. Globe Grain & Milling Company, Ogden, Utah, plans mill addition to cost $200,000.

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SOUTHEAST

—BUSINESS IN THE SOUTHEAST *was again confined to routine demands during the past week. Street-lighting projects are being undertaken in a number of districts.*

A municipality in Mississippi ordered street-lighting equipment to the amount of $5,000. One municipality in Georgia placed a small order for fire alarm equipment and another Georgia municipality placed an order for 50,000 ft. of cable, amounting to approximately $1,500. An Alabama utility company placed orders for regulators, transformers and bushings amounting to $23,500. Some other orders originating in the Southeast were as follows: Steel switchboard, approximately $4,800; poles, approximately $3,900; switchboard equipment, $4,000; transformers, $12,400; meters, $3,300; crossarms, $1,000; pole line hardware, $1,250; copper wire, approximately $21,700, and miscellaneous power plant equipment and supplies, $3,000.

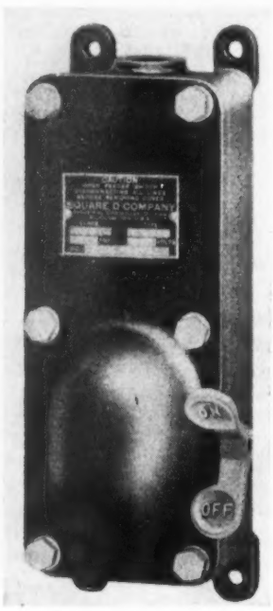
CONSTRUCTION PROJECTS

Virginia Electric & Power Company, Richmond, Va., has plans for an equipment storage and distributing plant to cost about $160,000; also, plans transmission line at Norfolk, Va., of 11,000 volts capacity and ornamental lighting system in last noted city. W. B. Tracy, Webster Springs, W. Va., is at head of project to build a hydro-electric power plant at Cathole Falls, for industrial service, to cost over $100,000. Knoxville Power & Light Company, Knoxville, Tenn., plans transmission line in Union County. Southern Public Utilities Company, a subsidiary of Duke Power Corporation, Charlotte, N. C., contemplates transmission line extensions in vicinity of Rutherforton, N. C. Prentiss, Miss., plans extensions in municipal electric light and power plant, and installation of additional equipment.

New Equipment Available

Explosion-Proof Push-Button Station

AN EXPLOSION-PROOF PUSH-BUTTON station is announced by the Industrial Controller Division of the Square D Company, Milwaukee, Wis. This class 9001 type BR-10 explosion-proof control station is provided with a contact



mechanism consisting of one normally open and one normally closed contact inclosed in a cast-iron housing with machined joints and so constructed that it will withstand an internal explosion without injury to the inclosure and without transmitting the flame to surrounding gases.

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Non-Metallic Sheathed Parkway Cable

A NEW NON-METALLIC SHEATHED CABLE which may be used in nearly every location where the metallic types were previously used has been announced by the General Electric Company. The construction of the cable, which has been designated as type CA, incorporates the use of jute and asphalt. In place of the metallic sheath previously used, successive wraps of hard, vacuum-impregnated, closely woven jute have been substituted. To replace the steel tape serving as a shock retarder on metallic parkway cable and as protection against mechanical injuries the new cable has been constructed so that it will have a cushion effect against any hard object in contact with it.

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A NEW LINE OF POTHEADS which are even more definitely tight than previous models has been announced by the G & W Electric Specialty Company of Chicago. Oil-tight gaskets between machined flanged surfaces assure oil or compound retention, capscrews hold the lids definitely tight, wet-process porcelain is used and changes in petticoat design give higher flashover values. Interchangeability of parts has been obtained. By standardizing on bodies, entrances, lids, connectors and porcelain, 3,500 combinations are possible with comparatively few parts. This facilitates the assembly of potheads to fit special conditions from stocked parts.

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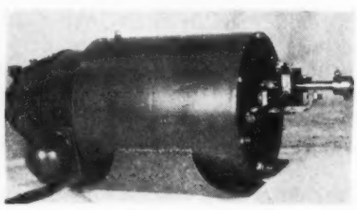
Combined Motor and Reduction Unit

A COMBINED MOTOR and three-speed reduction unit, to drive work-handling devices for automatic welding, has been announced by the Westinghouse Electric & Manufacturing Company. The requirements of the service are high gear reductions, with extremely wide speed ranges, and compactness. The gear ratios in the three gears are 534:1, 1,295:1 and 3,060:1. With field control on the motor an uninterrupted speed selection between 0.393 r.p.m. to 6.67 r.p.m. was obtainable at the final shaft of a recently tested unit.

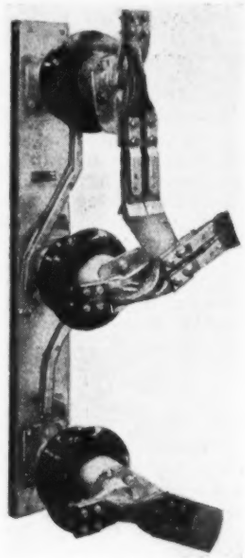
The torque output rating is limited by the strength and wear resistance of the mechanical parts. This is 1,500 in.-lb. with hardened gears and 400 in.-lb. with



soft gears. A sprocket load of 1,200 lb. is permissible on the final shaft. All gears are of the spur gear type and all bearings anti-friction. The gear shafts and bearings are mounted in gear frames which can be removed from the housing as two separate units for ease of inspection and replacement.

Heavy Ampere Capacity Gang-Operated Switch

A NEW TYPE OF HEAVY AMPERE capacity double-throw, three-pole, gang-operated switch has been developed by the Delta-Star Electric Company, Chicago, Ill. In this double-throw capacity switch, known as the type "PMF Form 2," the



characteristics of the original single-throw with its powerful ice-breaking toggle blade motion have been retained. Gang operation from the center insulator insures that one side of the switch is open before the other side is closed. Rugged, compact, simple in design and in line with modern trends, the "PMF Form 2" has a minimum number of insulators.

A single-pole, 1,500-amp., 15-kv. element is shown in the accompanying illustration.

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ADDITION OF A LINE OF TUBULAR RHEOSTATS to its resistor products has been announced by Hardwick, Hindle, Inc., Newark, N. J. Among the novel features which may be mentioned are, first, the screw engagement mechanism is so arranged that the act of grasping the knob to adjust the slider by hand automatically disengages it. This device is self-supporting, self-aligning, non-binding. The heavy phosphor bronze contact shoe presses firmly against the wire but cannot tear it. Due to new spring arrangement on the shoe, there is no current carried through it, consequently the pressure springs cannot have their tension reduced by overheating.